EASTERN CONCERNS HAVE A CHILL.

The demand for power and motive equipment in Vancouver is a good criterion of the trend of the times. Power in use makes work for a multiplicity of hands. Power drives wheels and wheels turn machines, while skilled men are required to operate them. Skilled salesmen and clerks have to do with the disposal and shipment of the products. Railways must move these and men must operate the trains. Power is the root of much commercial activity and there is no more promising indication of the continued industrial activity of British Columbia than the present exceedingly active demand for both power and equipment right here in Vancouver. Local equipment houses were never so busy as at the present time and December has witnessed one of the largest month's sales they have ever enjoyed. One house has a single order requiring $38,000 worth of transformers alone. Telegraph orders for carloads of equipment are constantly being sent forward to rush the big shipments needed for immediate delivery.

This condition obtaining simultaneously with the completion of the British Columbia Electric Railway Company's new 10,000 horse-power unit at Lake Buntzen is a very promising augur for not only a continuation of our present and past prosperity, but a greater industrial activity than ever, for the immediate future.

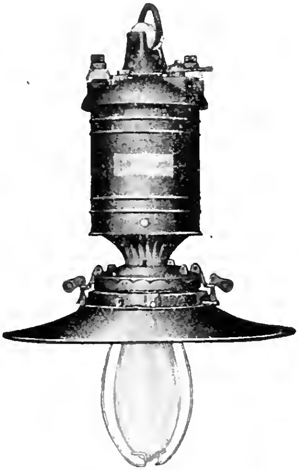
In discussing this situation a prominent business man says that manufacturers and other British Columbia business men seem to be preparing to seize the opportunities which Easterners, who have contracted a chill in their pedal extremities, are leaving open to them. The fact is that many Eastern manufacturers have underestimated the situation in the West, and in the belief that matters are much worse than they are have relaxed their efforts in this market.

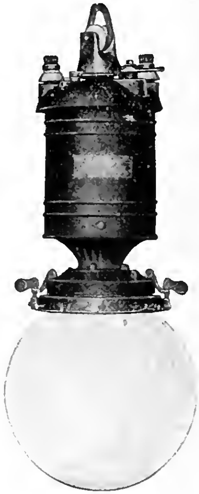
This is shown by reports constantly coming in to the effect that Eastern wholesale houses are withdrawing their travelers. One big house has taken off all its travelers and is sending instead a weekly list to its customers. Western wholesale houses and manufacturers are apparently getting ready to capture the trade the Easterners are neglecting and Vancouver people are taking the lead in the movement.—Saturday Sunset.

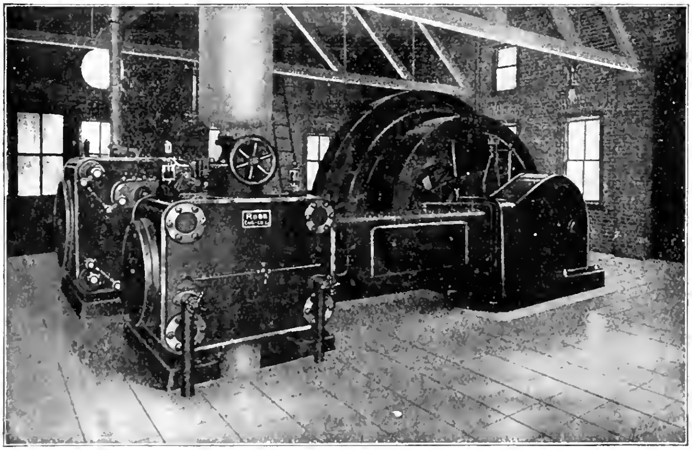
MEGGERS AND BRIDGE MEGGERS.

From Evershed & Vignoles, Limited, Chiswick, London, W., we have received a booklet describing that firm's patent meggers and bridge-meggers for testing insulation at or above working pressure. The bridge-megger is particularly adapted for the measurement of low resistance. The publication contains numerous diagrams describing the apparatus, together with information as to prices and instructions for using.

No fewer than 9,800 electric lights now burn in the homes of the inhabitants at Orillia, Ont. One thousand four hundred of these were installed during the past year.







Robb-Armstrong Cross Compound Corliss Engine at Electric Station, Town of Owen Sound, Ont.

CANADIAN
ELECTRICAL NEWS
& ENGINEERING JOURNAL

PUBLISHED ON THE TENTH OF EVERY MONTH BY

HUGH C. MacLEAN, LIMITED,

TORONTO, CANADA.

ADVERTISEMENTS.

Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.

The ELECTRICAL NEWS will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

The Thury Transmission System.

We in this country, soaked to the core with the idea that nothing but alternating current can be successfully used for anything but the very shortest and smallest transmission, can scarcely conceive that in Europe direct current is used for what is probably the longest transmission on that continent. We refer to the French installation, using what is called the Thury system, to supply Lyons with power from a hydraulic generating station at Moutiers, some 110 miles away. In addition to being of no mean length, the plant is fairly large, something over 4,000 kw., from all of which it will be seen that those responsible for its installation are fairly confident that the system used has passed the experimental stage. A short description will undoubtedly be interesting to us, so long accustomed to regard alternators and transformers as indispensable.

The Thury system consists of one or more direct current dynamos, operating at a constant amperage, very similarly to our standard direct current series arc systems, the receiving end or load consisting of a series wound direct current motor driving constant potential dynamos, either direct or alternating, from which latter are led the various circuits required for the individual consumers. Regulation is accomplished by varying the voltage of the generators, from which it follows that at partial loads the voltage on the system is proportionately reduced, or in other words that the equipment is under full potential stresses for full load periods only. This is, of course, exactly contrary to the conditions obtaining in our practice, where full potential all the time is the invariable rule. Another curious result, following from the use of a constant current, is that the losses in the generators, motors, and line, are constant, irrespective of the load. This naturally makes the efficiency show up rather poorly at partial loads, though the point is not important in hydraulically driven plants possessing an abundant water supply. As a much more real disadvantage might be pointed out, the fact that owing to the well-known difficulty of building commutating machines for anything but comparitively low voltages, the size of the units is very limited, both at the generating and receiving ends. For instance, those in the Moutier-Lyons plant are wound for a maximum of 3,700 volts at 75 amperes, or about 275 kw. each, a very small machine compared with units of about 1,500 kw., which would be about the size selected for a 4,000 kw. system of our design. There are 16 generators in the Moutiers station, coupled in groups of four machines each to four hydraulic turbines.

The main advantage claimed for the system is its economy of copper, particularly when it is remembered that by grounding a point midway among the generators, and also one at a corresponding point in the motors, a system is obtained which is the exact counterpart of our three wire grounded neutral plants. In fact the claim is made that not only are the potentials between lines and ground cut in half, which is of course correct, but that one-half of the system can be operated, using the ground as a neutral conductor, even should one of the live wires become broken. Further than this, it is quite feasible to operate even the broken side, assuming that receiving stations are scattered along the line, up to the point where the trouble has occurred, the only changes necessary being to ground the generator end of the break, and adjust the generated potential on that side to the required point. In addition to the economy in copper, the system has quite an advantage in the matter of switching, the equipment required for this purpose being much more simple and far less costly than for an alternating plant of equal voltage and capacity. As against these various advantages there are, as is but natural, several drawbacks. The difficulty of regulating is one, as, owing to the bad sparking produced if the field be weakened too much, it is not possible to use field regulation for the whole range necessary. Consequently the complication of a combined field and speed variation has to be introduced. Another rather serious difficulty is that of distributing small quantities of power at various points along the line, the system being obviously most suitable for transmission to one point only. However, the problem appears as if it were gradually being solved, as is evidenced by the successful operation of the system described above, besides that of several smaller plants, among which might be mentioned that from St. Maurice to Lausanne in Switzerland, operating at 22,000 volts. The system is also being discussed for a 140,000 volt transmission from Switzerland to Paris, France, and for the Victoria Falls project in Central Africa, an equipment which would comprise a transmission of some 500 miles. Without doubt the future development of the Thury system, curious and impractible as it may seem to us, will be watched with great interest by all engineers, but particularly by those on this side of the water.

The Cheap Power Movement.

For the last four or five weeks of 1907 Toronto was the scene of a very strenuous campaign between the advocates of munipally distributed energy on the one hand, and on the other two of the several large organizations which are most vitally interested in the outcome of the movement, namely, the Electrical Development and the Toronto Electric Light Companies. The issue was the proposed by-law authorizing the City of Toronto to install and operate a civic distributing plant, a power sought by its as an alternative to the purchase of the Toronto Electric Light Company's plant at a mutually agreeable price, a right already possessed, though a confirming by-law would be necessary to complete any agreement. The right to expropriate has not yet been conferred, though it will very possibly be applied for at the next session of the Legislature.

The campaign was remarkable in many ways, consisting as it did of a struggle between a government policy, and those who endorsed it, against a more or less veiled opposition. Then, again, the public press, with one exception, was strongly in favor of the movement. Lastly, all but about two of the seventy or eighty candidates for municipal offices publicly avowed themselves as strongly in favor of it, and these two were severely left at home. The voting was also very peculiar in that while but 50 per cent. of those entitled to vote for municipal officers went to the polls, the ballots cast on the power by-law were 80 per cent. of the possible maximum. It was generally felt that it would carry, but the actual result was perhaps the most peculiar feature of the whole matter, both supporters and opponents being exceedingly surprised, not to say astounded, by the overwhelming majority recorded for it, namely, about 3 1-2 to 1. A week later practically the same question was fought out in a number of Wester Ontario towns and cities, such as Hamilton, Brantford, Guelph, London, etc., with substantially the same result. The only dissenting vote was in Ingersoll, where the proposition to purchase the local light company for $50,000, which was coupled with the Niagara power question, was voted down. The average of all the other votes was about 3 to 1 in favor of municipal power. That this would be the case was practically a foregone conclusion after the result of the Toronto voting was known, that city being looked upon as the keystone of the situation. In view of this, both sides worked very energetically in that election—in fact, the movement in favor of the by-law was such as to elicit more or less free comment that money from opposition companies was being used to ensure a favorable vote.

Without doubt any move towards cheaper electrical energy is, in the abstract, a good thing, but at the same time those behind it must take great care to see that the interests already in the field are properly compensated for any legitimate rights which may be impaired or taken from them. Failing this, not only would a great wrong be done to Canadian capital and energy, but Canadian investments as a whole would be put in anything but a pleasant light in the eyes of the English financial public. This, of course, is a thing which no one interested in the welfare of Canada can afford for an instant, even if the return were power at half the price, and so it behooves those responsible for the movement to proceed with extreme caution. There is absolutely and without question no room in Toronto, or Hamilton, or London, or any other Canadian city, for two plants, because, entirely outside of the complexity and wastefulness of two systems, each ready and offering to serve the same district, there is not enough business offering to afford an adequate return when divided among two organizations. This being the case, it is hard to see how the entrance of a municipality into a field already occupied by a private organization can result in anything but dissatisfaction and heavy financial loss to both, rate cutting, and the division of a business even now none too large for the support of the equipments already installed, being practically inevitable. In view of this, is it not imperative that the various municipalities, who desire to operate their own plants, should negotiate with, and purchase, by arbitration or otherwise, the private plants now operating in their respective territories. Any other course will surely bring great trouble, if not actual disaster, to one or the other, perhaps both, besides laying the municipalities open to a charge of bad faith. Various Ontario cities and towns have already purchased the private plants operating within their boundaries, and claim to be satisfied with their bargains. Why, then, should anything but the same course be followed in the present instance?

WIRELESS OVER MOUNTAIN.

The system of wireless telegraph stations recently installed on the lower coast of British Columbia by the Dominion Government has been successful in communicating over land sections, a thing which Superintendent Doutre was sceptical about when the system was first installed. It was expected that Pachena and Victoria might have to talk through the medium of the United States station at Tatoosh, owing to the mountains intervening between Pachena and Victoria. This has not been the case, however, as communication is now going on regularly between the points mentioned.

News of an unexpected record was received on December 29, however, when the operator at Victoria picked up the following: "This is the steamer Portland, off Cape Mudge, waiting for the tide." This message, sent from a point off Seymour Narrows, on the northeast coast of Vancouver Island, had to cross a high ridge of mountains, which, added to the distance of about 150 miles, is regarded as very creditable for the limited power of the station.

Capital and money may be timid, but if the banks don't soon begin to go along in the old way the people will have something to say that will jar sensitive nerves. The future is up to the banks.

Power Plant of the Montreal Water and Power Company.

We reproduce herewith photographs of some of the electrically driven apparatus of the Montreal Water & Power Company now in operation.

Fig. 1 shows a five and a half million imperial gallons reciprocating triplex pump, and a two and a half million imperial gallons reciprocating duplex pump, driven by a 500 h.p. S.K.C. synchronous motor. The triplex pump is the first large electric pump installed

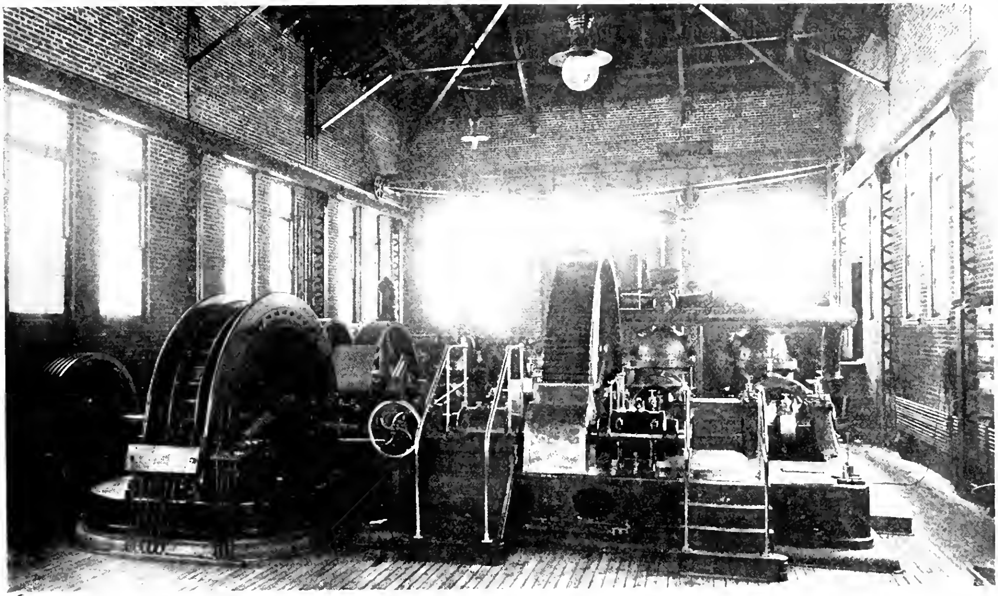


Fig. 1

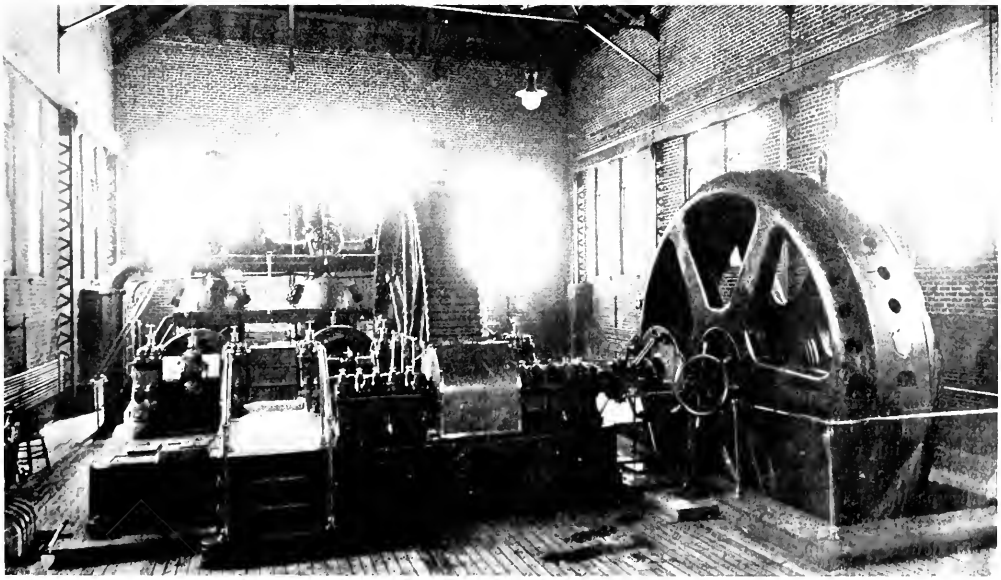


Fig. 2

and put into operation for water-works purposes in America.

Fig. 2. shows a five and three quarter million imperial gallons triplex pump operated by 400 h.p. induction motor. The pumps shown in photographs Nos. 1 and 2 are installed at the river and constitute the main electric pumping station. There is on order for this station in England, an additional fifteen million gallon electric turbine pump to be driven by a 2,500 h.p. induction motor and to work, eventually, against 175 pounds per square inch; and also a reserve steam plant for this elevation of 200 feet above the river.

Fig. 4 shows the first important electrically driven turbine pump installed in Canada. It is by Mather & Platt, Manchester, and has a capacity of five and three-quarter million gallons; two-stage high lift turbine pump, driven by 550 h.p. three-phase induction motor and is designed to work against 175 pounds per square inch, when moved to the lower station with an auxiliary pump for increasing its present head of 300 feet; the speed of this pump is 750 r.p.m.

In the same station is installed the plant represented

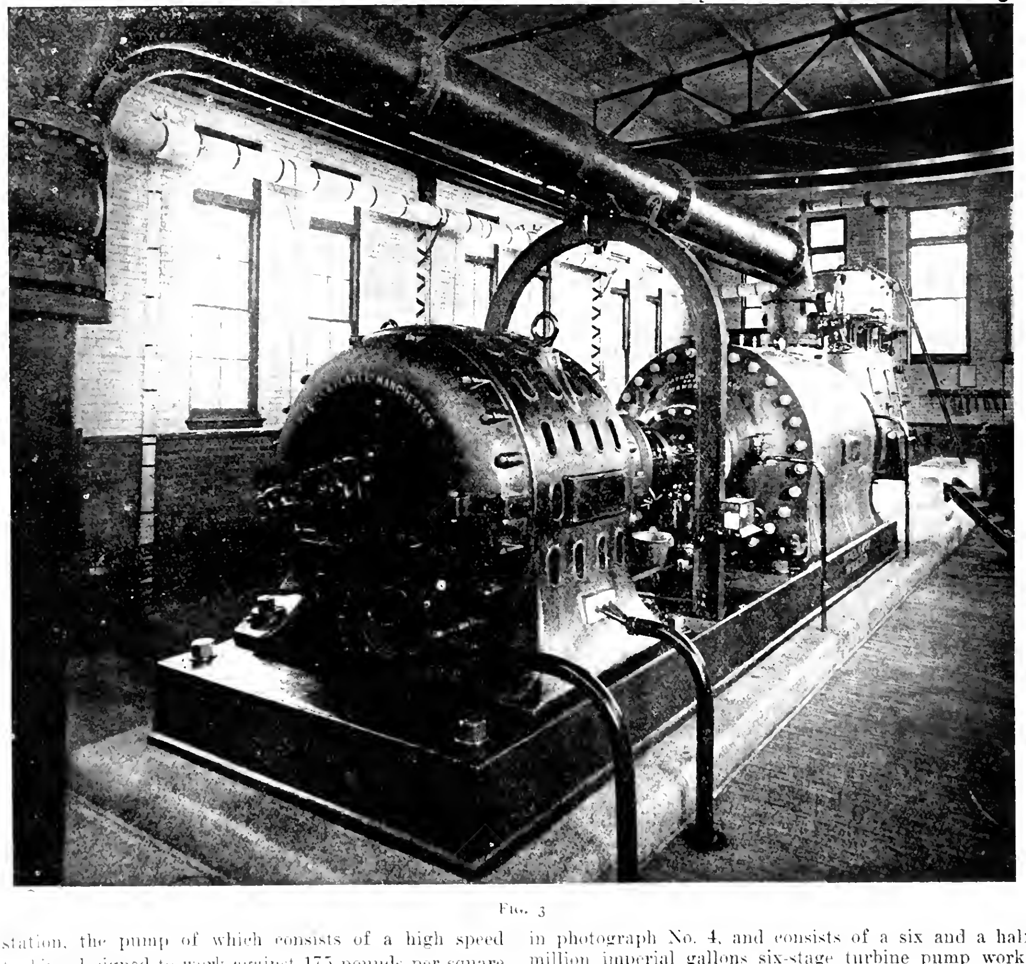


Fig. 3

station, the pump of which consists of a high speed turbine designed to work against 175 pounds per square inch and to be driven by a 2,500 h.p. Zoelly steam turbine. The boilers will be Babcock & Wilcox boilers, and work is now in progress for an extension to this station to receive these new pumps. This will afford an additional capacity of thirty million gallons at this station, and the latter high head is chosen in order to avoid most of the double pumping at present necessary at the Clarke avenue station of the company, situated at an in photograph No. 4, and consists of a six and a half million imperial gallons six-stage turbine pump working against 300 feet and driven, under ordinary circumstance, by 600 h.p. induction motor-pump and motor being by Mather & Platt. There is an alternative reserve steam drive at the other end of the shaft consisting of 600 h.p. Belliss & Morcom triple expansion condensing engine. This plant runs at the comparatively low speed of 337 r.p.m.—the steam engine limiting the speed to that figure.

Both of these plants have been found extremely satis-

factory, in point of, first cost and operation, an overall efficiency having been obtained, when electrically driven, of 68 per cent. on the plant represented in photograph No. 3, and 66 per cent. on the plant represented in photograph No. 4. Both these plants operate without appreciable noise, and absolutely no vibration, and, so far, the cost of repairs has been nil.

The first high lift turbine plant was installed two years ago last May, and the second about a year ago.

From observation in England and on the Continent,

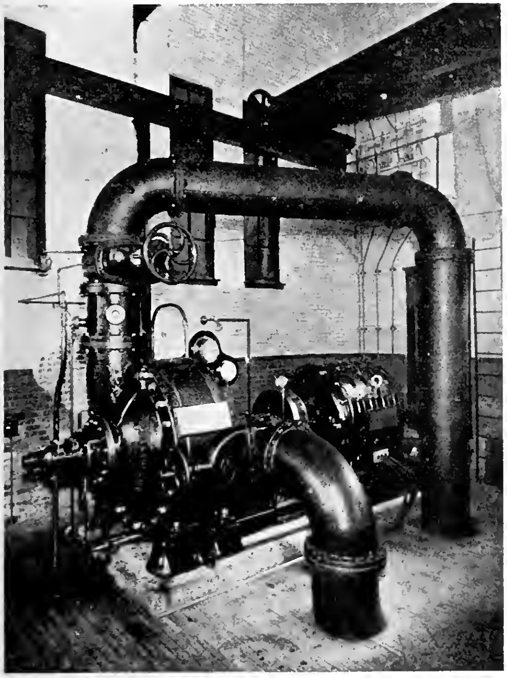


FIG. 4

of engineering work in connection with water supply, one is led to believe that the day of reciprocating pumping engines has passed away, and that either steam or electric drive with the type of pump illustrated in photographs Nos. 3 and 4 will come into general use.

TO PROTECT TREES FROM ELECTRIC LINES.

Trolley or electric-light lines are injurious to trees in at least two ways—burning from contact with wires carrying high-voltage currents, and mechanical injury from the attachment of guy-wires. The question of protecting the trees, says an editorial writer in "The Street Railway Journal" (New York, November 30th), has received attention from electric-light and power companies, and perhaps also from some electric railways. There is no doubt, he says, that the attitude of a company in regard to tree-protection exerts a wide influence on public sentiment, and suggestions from responsible authorities on the growth of trees and their protection against improper wiring should always be given careful consideration. He continues:—

"A paper by Prof. Geo. E. Stone, of Amherst, in a recent number of 'Woodland and Roadside,' treats the protection of trees in a broad way, which seems fair both to the electric companies and the public. . . . It appears that some methods of attaching wires to trees are extremely injurious, while others are not so harmful, and if properly employed will seldom or never cause the tree to be damaged. For example, Professor Stone states that the usual method of guying a pole to a tree by means of a log bolt driven into the back side of the tree, the wire being kept away from the tree by rough bits of wood, is to be condemned, since in a few years the wire is certain to become embedded in the bark and cause partial girdling, and the log bolt will also become embedded as the tree grows. Placing a wire around a tree directly is sure to cause strangulation and kill the trunk or limb to which it is attached. According to Professor Stone, the best method of guying to trees consists in having a large loop of wire passed around the tree, the tree being protected from the wire by oak or hard-pine blocks grooved in the middle. The loop should be made large enough to allow for the future growth of the trees and shoud be clamped in place.

"Much injury to trees has been prevented by the use of wooden sleeves which surround limbs where wires would come in contact with them. In some cases, notably in Boston, good results have been secured by sleeving the feed-wire as it passes the trunk or limb. Professor Stone points out that many cases have been known in which trolley feed-wires have been in direct contact with sleeve-protected trees without producing the slightest burning. Attaching wires to trees by means of a porcelain insulator does not prevent leakage in wet weather, and many deaths of trees are attributed to this cause by Professor Stone, who states that trees often get severe shocks by this method of connecting. He states that lightning discharges sometimes pass to trees in this way via trolley guy-wires. From the standpoint of the operating company, however, it is hard to see how protection against lightning can be expected of it in its attachments of this kind.

"Professor Stone concludes with a plea that trolley poles be braced in Portland cement instead of by wooden guys where they are in close association with trees, urging that the life of the pole in the ground will be increased in addition to the protection given the tree. He concludes that guying to a tree is preferable to unsightly makeshifts of any character. The cost of embedding poles is something of an item, but it is certain that if more thought is given to specific pole-line installations in relation to their surroundings, many operating companies will not regret the consideration paid to the subject, from the standpoint of policy alone, leaving aside the actual physical results. In fact, there is more than one electric railway in the United States attractive to the trolley tourist because of giant elms, oaks, and other trees along the wayside. The protection of such trees is surely a matter of self-interest to the local railway as well as to the community."

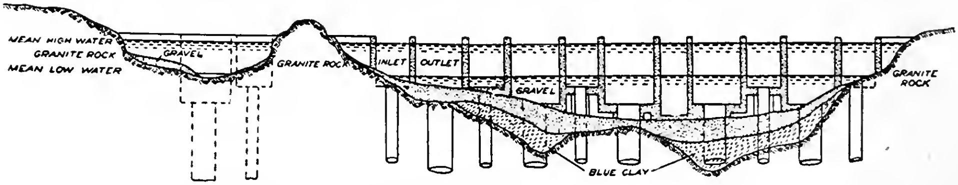
PRACTICAL POWER FROM THE TIDES.

The project of a large plant to be erected at South Thomaston, on the Maine coast, to compress air by the inflow and outflow of water in a large tidal basin, has already attracted considerable attention. Further information has been communicated to "The Engineer" (Chicago) by William O. Webber, who gives details of the lock and gates, a plan and sections of the construction at the same point, and a profile of the location at South Thomaston. Says Mr. Webber:—

"At this point the maximum tide is 10.6, mean tide 9.4, and minimum tide 7.9 feet, giving, respectively, 5,000, 4,000 and 3,000 horse-power.

"In the dam, where the main channel is navigable, will be a lock for vessels, 40 feet wide, 200 feet long, and 28 feet deep. On either side of this lock will be one or more sets of shafts, each making a unit, or compressor, of 1,000 or more horse-power. These shafts will be sunk into the rock to a depth of 203.5 feet below mean low water, the downflow shaft being 15.75 feet in diameter, and the upflow shaft 35.65 feet in diameter. The inflow gates will be five in number and 10 feet wide, the outflow gate six in number and 10 feet 8 inches wide.

"The water on entering the inflow gates will swing them open, pass down the downflow shaft at a velocity of 16 feet per second, drawing in air through about



1,500 half-inch inlet tubes. Arriving at the bottom of the shaft, the combined air and water will flow in both directions horizontally, the air separating from the water until all of the air is accumulated in the separating-chambers. The water will then flow up the up-take shaft at a velocity of three feet per second, and out through the outflow gates.

"The air entrapped in the air-chamber is then under a head of water 195.5 feet high, varying with the height of the tides. This compressed air is then led up the upflow shaft in a 14 inch pipe. At the top of the gates these 14-inch pipes are united into a 30-inch pipe, which conveys the air ashore."

The air thus compressed, we are told, will contain only about one-sixth the moisture that is in the atmosphere from which the air is drawn. This dryness makes it particularly adaptable for transmission to considerable distance, in pipes, without undue friction. The author states that the whole 5,000 horse-power could be transmitted 1 mile, in a 30-inch pipe, with a loss of only 1.5 pounds pressure, or 10 miles, in a 48-inch pipe, with a loss of only 2.5 pounds pressure. We read further:—

"This air can be used cold, without danger of freezing in expanding, in steam engines or rock drills. A test was made on an 80 horse-power Corliss engine, in which the entering air was 5.3 degrees F., and the exhaust minus 40 degrees, and continued for ten hours without the slightest sign of frost in the exhaust passages and pipes of the engines. A marked economy, however, is obtained by pre-heating this air immediately before using it in motors, as raising the air to 370 degrees will practically double the volume of the air, and, instead of requiring 3 to 4 pounds of coal per horse-power per hour, as air receives heat about six times as easily as water, these results can be obtained at an expenditure of from 1-2 to 5-8 pound of coal per horse-power per hour.

"As there are no working parts in the compressor, there is no depreciation, or operating expenses, to be taken into account, excepting watchmen to prevent depredations on the plant, keep ice and floating timbers from permanently obstructing the inlet racks, and operate the boat-lock. Therefore the cost per horse-power is practically represented by the interest on the original investment and the wages of these watchmen. The cost of original construction will amount to about $100 per horse-power.

"There are numerous places, all practically situated between the 40th and 50 th parallels of latitude, in both the northern and southern hemispheres, where the tides are of sufficient magnitude to make this plan commercially feasible, the necessary requirements being a tidal basin, of considerable size, connected with the ocean by a comparatively narrow outlet. Each acre of such basin, under a 9-foot tide, is capable of producing 5 horse-power. It is not commercially feasible to develop such a plant with a basin containing much less than 200 acres, or requiring a length of dam exceeding 3 feet per acre of pondage."

THE LATE LORD KELVIN.

At Glasgow, Scotland, on December 17th last there occurred the death of Lord Kelvin (Sir William Thomson), perhaps the greatest scientist of the age. For the past twenty years he had been suffering from facial neuralgia which he bore with such patience that few realized his affliction, but it was only two weeks prior to his death that such serious complications set in that death resulted.

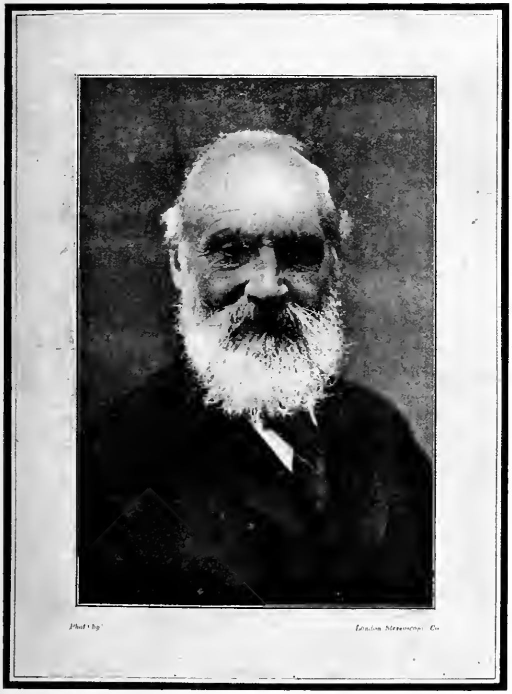
Personally Lord Kelvin was one of the most charming of men; his modesty and the way in which he inspired affection in all who met him, and the interest and sympathy which he showed towards every one, endeared him to all.

Probably no one has contributed more to the development of physical science than Lord Kelvin; not only was he the leader of his own time, but he was certainly one of the most remarkable men of all ages.

His work in science, while devoted mainly to physics, was often turned to other fields, and he did not disdain to use his great knowledge for putting scientific discoveries to actual use. In fact part of his work of the most immediate importance was that which he gave to developing useful electrical methods and apparatus. He is known as the father of electrical engineering, and surely no one has done more to put this profession on a scientific basis, and in this way raise to a high standard the entire engineering profession.

Lord Kelvin was the son of William Thomson and was born on June 25th, 1824, at Belfast, Ireland, where his father at that time was professor of mathematics. In 1830 the Thomsons removed to Glasgow, as his father had been appointed professor of mathematics at the university there. William was then eight years old, and at the age of ten he was sent to school, and a year later he entered the university at Glasgow, where he soon distinguished himself by taking first prizes in mathematics.

From this time until 1899, when he gave up his professorship, with the exception of six years spent as a student at St. Peter's College, Cambridge, and a short time in Paris, he was connected with the University at Glasgow, either as a student or a member of the faculty. In order that his almost lifelong connection might not be severed he registered as a matriculate after his resignation.



THE LATE LORD KELVIN.

The abilities of this great man are hard to chronicle. His earliest work which brought him a reputation was in mathematics. In fact his defence of Fourier's theorem in harmonic analysis, written in 1840, when at the age of sixteen, was the first paper he published.

In 1846 he was appointed professor of natural philosophy at Glasgow. At that time he was only twenty-two years old, but even then he was recommended for the position as "the first man of science in the rising generation in England." During the following years he gave much attention to geological theories, using with wonderful effect his great mathematical skill.

It was in telegraphy that he showed his remarkable combination of mathematical ability and mechanical ingenuity which distinguished his work. Land telegraphy had been fairly well established and a number of shorter cables laid successfully, but these gave some trouble, and the theory of their behavior was not clearly understood. Thomson took up the subject and worked out a mathematical theory showing how the behavior of the cable depended upon its dimensions and how it might be improved. It was at this time that he used the hydraulic analogy to make clear to those readers who could not follow the mechanical argument. This notable accomplishment led to his appointment as electrician for the Atlantic Telegraph Company, and he assisted in laying the first Atlantic cable in 1857, after two unsuccessful attempts. In this work Thomson was the main reliance, not only for his grasp of the physical theory, but for the mechanical skill displayed in overcoming the difficulties of the work.

He invented his galvanometer to aid in the work and showed the necessity for using pure copper, requiring the company to specify for the first time copper of "high conductivity" for the cable. The failure of this cable, due to mechanical imperfections merely, encouraged him to continued study, which led to the successful laying of the second cable in 1866, whereby permanent communication was established.

In recognition of his great service in this work he was knighted, and under the name of Sir William Thomson was long affectionately known.

His taste of sea life while laying the cable brought to his attention the imperfections of the mariner's compass in those days, which resulted in the invention of the greatly improved instrument which to-day is the standard of the world.

During the seventies and early eighties he gave considerable thought to electrical applications, designed a number of dynamos and showed, in 1879, that economical high-tension electrical transmission was possible.

In 1892 he was raised to the peerage and upon him was conferred the title of Lord Kelvin.

He visited America in 1897 and again in 1902. In 1896 there was a great celebration at Glasgow in honor of his fifty-seventh year as professor at that university.

Even within the last few years he had shown no lessening of mental activity and had taken an important part in the discussions of the most recent physical problems.

His death leaves a vacancy which no one to-day can fill.

New College Exchange, Bell Telephone Company, Toronto

For their College Exchange in Toronto, the Bell Telephone Company of Canada have recently completed the installation of an entirely new central office equipment, which has many interesting features.

The building was erected by the company on the southeast corner of Bellevue avenue and Oxford street, in a good residential locality. It is a handsome three storey and basement structure with 50 feet frontage on Bellevue avenue and 120 feet frontage on Oxford street, and was designed to harmonize with the character of the adjacent surroundings, with which it is in perfect keeping.

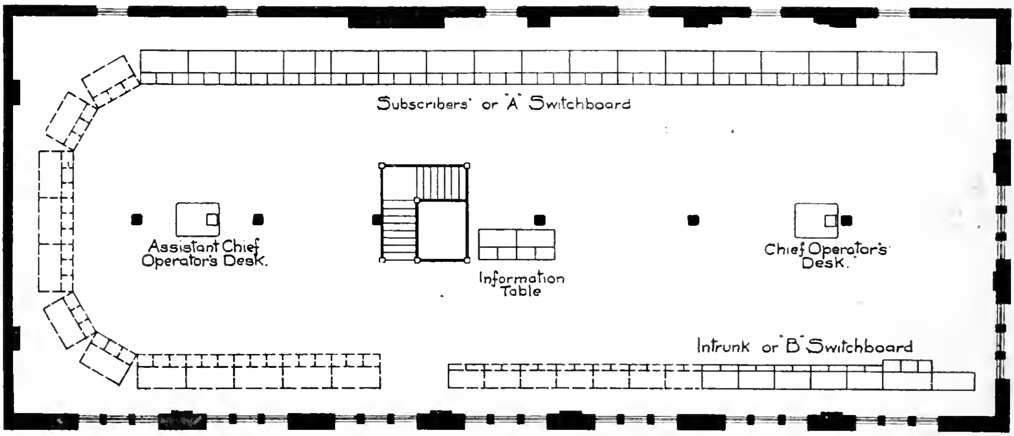
The basement walls of the fronts, to the level of the ground floor window-sills, are of dressed Indiana limestone, above which the walls are of light buff brick with Indiana limestone trimmings.

The main entrance is in the middle of the Oxford street front. About half the ground floor space will be occupied by the company's various clerical offices, while the balance will be utilized for special training school for operators.

On the first floor, at the top of the main staircase, are rooms for the accomodation of the operators employed in the exchange. These consist of a large retiring-room and sitting-room furnished with chairs, lounges, tables, etc. There is also a small kitchen, which is in charge of an attendant and from whom operators may obtain tea, sugar and milk, furnished free by the company, when off duty. Adjacent to these are lavatories, a bath room and locker room. In the locker room is a clothes drying apparatus, by means of which wet wraps may be dried before being placed in the lockers, which are of open mesh expanded metal, each large enough to accomodate the belongings of two operators.

Crossing the entire Bellevue avenue front of the building, occupying not quite half of the first floor, is the terminal room, which is devoted to the distributing and power apparatus used in connection with the switchboard.

The top floor is devoted entirely to the switchboad and is one of the best lighted, best ventilated and most convenient operating rooms in the country. Somewhat of a departure has been made in the construction of the floor of this room, it being built on two levels, the centre part, between the two rows of switchboards, is 13 1-2 inches higher than that upon which the switchboards themselves stand, with the result that, while men working at the back of the boards have the same ease of access to the apparatus as if the floor was on one level, the operators sit upon a chair of normal height and have no necessity for using a foot rest, as is the case with the usual chair which is required with a floor leveled throughout. With this arrangement the difficulty of reaching such high numbers, as require the operator to stand up when she is plugging in, is somewhat lessened, and, at the same time, the supervising operators, who stand behind the regular operators, have a much better chance to see the board and aid them. The whole scheme is somewhat novel, it being the second exchange in Canada (and, as far as we know, in America) to be so constructed. Consequently it is being watched with considerable interest and may be adopted in future exchanges of the company's.

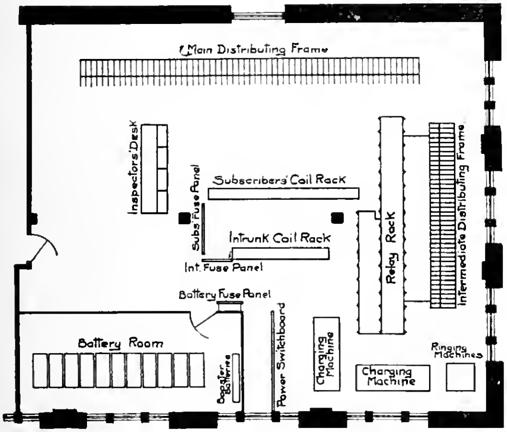


Floor Plan of Operating Room, 115 x 45 Feet, Bell Telephone College Exchange, Toronto.

The equipment is of the usual standard battery or relay type, using lamp signals, and is similar to that in use in the main office at Toronto.

The lines enter the building underground in 400 pair lead covered paper insulated cables, which are connected to the main frame by silk and cotton insulated lead covered cables. The main, intermediate and relay frames, the coil racks for the line and intrunk board with their fuse panels, the power plant and the wire chief's desks are all located in the terminal room on the first floor, arranged as shown in the plan.

The power plant consists of the main battery of 11 G-41 chloride cells and 11 E-11 cells, this last battery being used to reinforce the main battery for long distance work and also to operate certain keys and signals. Two machines are provided for charging the larger battery, one being held in reserve in case of a breakdown. Each consists of a Western Electric Company's D.C. motor direct coupled to a Western Electric Company's dynamo of 18,000 watts capacity at 30 volts, the two being mounted on a common sub-base. The generators are specially designed for charging telephone batteries, having a large number of segments in the commutator, and peculiarly shaped pole pieces, the idea being to eliminate noise from the associated telephone circuits when the battery is being charged. The smaller battery is charged by a similar motor generator, which has an output of 750 watts. Two machines are provided for furnishing current for ringing subscribers' bells and working the many signaling circuits operated by an interrupted direct current. One of these machines is



FLOOR PLAN OF POWER ROOM, BELL TELEPHONE COLLEGE EXCHANGE, TORONTO.

run from the street circuit motor, the other is a dynamotor run from the main storage battery. The necessary switches, circuit breakers, measuring instruments, etc., are mounted on a black slate switchboard, the cables from which are carried to the machine and fuse panels along the basement ceiling.

From this terminal room the lines are run to the switchboard on the floor above in switchboard cables supported on structural steel runways. The switchboard is known as the No. 1 relay type, having a capacity of 10,400 lines and equipped at present for 5,600 lines, about 4,000 of which are working. Two separate switchboards are provided, one to answer originated calls of subscribers whose lines terminate at the exchange, and which is known as the "A" board; the second switchboard is required to complete calls which have originated at other offices for subscribers' lines terminating at this exchange. This switchboard is known as the trunk or "B" board. There are eleven positions adapted to receive calls from other exchanges, and one position for the long distance business of the office, each "B" position having a capacity of twenty-seven trunk lines. The "A" board consists of forty-eight subscribers, operators' positions and two testing positions, each operator being able to handle the calls from about one hundred and thirty subscribers' lines. Two desks are provided for the chief operator and her assistants, each equipped with facilities to enable them to properly direct the force of the exchange.

A small four-position switchboard is placed in the middle of the room for the information operators who answer enquiries from the subscribers with regard to new numbers, changes and miscellaneous enquiries.

On the whole, the exchange is one of the best and most attractive in the country, thoroughly up-to-date in every particular, and should enable the company to give the best service to its subscribers.

MONTREAL CONTRACT.

The Fire and Light Committee of Montreal adopted a motion on December 30th last that a contract for the electric lighting of the city streets and squares be awarded E. A. Roberts and associates for ten years at the following prices: Arm lamps on wodden poles, per annum, $55; on ornamental iron poles, $57.50. For the electrical energy for lighting, heating and industrial purposes for the city and citizens of Montreal during the same period the rates are: For incandescent lights, ten cents per kilowatt hour, with cash discount of 5 per cent. for payment in ten days on contracts for the term of one year or over, and 10 per cent. for payment within ten days on contracts for five years. The contractors are prepared to complete the placing of wires underground within two years from the signing of the contract in the congested district, and in any other district to place their wires underground simultaneously with the placing underground of the wires of all other electric light and telephone and telegraph companies.

The power necessary to carry out this contract will be developed from the Beauharnois water powers.

TORONTO CARRIES POWER BY-LAW.

By a majority of 9,595 the power by-law was carried in Toronto New Year's Day. This was made the main plank in the platforms of the various mayoralty candidates and from the first week of preparation for the final contest it was evident that the supporters of the by-law would have their way.

ELECTRIC SMOKE ABATING.

Electric air filtration is the idea of an English engineer, and is based on the discovery that a body positively electrified by 100 volts or more will become covered with soot in a single day in a smoky atmosphere, while a negatively charged body remains clean. Inserting a sheet of wire gauze in the intake flue of a ventilating system and electrifying it by connecting to a 250 volt supply main, the gauze extracted a large quantity of soot from the air.

HIGH TENSION INSULATORS FROM AN ENGINEERING AND COMMERCIAL STANDPOINT.*

By C. E. Delafield.

The science of properly and safely insulating line voltages of high potential has not kept pace with the demands of transmission engineers, and to-day we are face to face with the problem of successfully transmitting potentials in excess of 100,000 volts. In California power is transmitted at 60,000 volts more than 200 miles, but great line losses are suffered and the investment in copper is heavy. An increase in voltage from 60,000 to 150,000 would make it possible to deliver this power with reasonable losses and in much greater quantity. As an illustration of the possibilities of delivering power at 150,000 volts, it would be possible to deliver the power generated at Niagara Falls economically to Boston, New York and Philadelphia, and, apparently, the principal hindrance to this consummation at the present time is in the fact that there is not on the market what might be termed a successful insulator for this enormous voltage, although the merits of a number of different types of insulators are at the present time being advocated for this purpose.

The design of an isulator for high voltage—quoting the words of Gerry—should involve a consideration of all of the effects of electrical tension on the dialectrices in the vicinity of the conductors. In the case of a line insulator, air is always a dialectric in combination with wood, porcelain, glass or other materials, and, wherever there is a difference of electrical potential, there exists in the sourrounding media a certain state of strain called an electro-static field. This state of strain is the result of electrical stress applied to the insulating material. It frequently happens, when several dialectric materials are subjected to the same electro-static field, that one or more of the materials will be strained beyond the limit and fail, although the others will stand the electrical tension. Air adjacent to powerful dialectries frequently fails in this manner, thus giving rise to the well-known brush discharge. The structural failure of air from an engineering standpoint has been studied by a number of investigators, including Dr. C. P. Steinmetz, Dr. F. A. C. Perrine, Prof. Harris J. Ryan, Mr. M. H. Gerry and others, and, as a result of their published investigations, it is well known that air at the ordinary pressures and temperatures has a much lower dialectric value and strength than the common insulating materials. Air in thin films, adjacent to solid bodies, has greater strength than in bulk and is still inferior to such substances as glass and porcelain. The dialectric strength of air is affected by its physical condition and varies directly as the pressure and inversely as the absolute temperature. Under uniform conditions dialectries rupture at definite applied tensions, Prof. Ryan having shown that there exists for each dialectric material a certain strength of electrostatic field, which will cause a rupture. These being the fundamental rules by which designing engineers formulate their plans for the manufacture of insulators for varying potentials, it can well be seen that the various forms of insulators on the market to-day are the results of working out these rules by different individuals looking at the same thing from a different standpoint. That is to say, climatic and geographical conditions exert considerable influence in the design of an insulator. Insulators suitable for dry atmospheric conditions would not be suitable for a condition where sea fogs and dust exist, and there is no question but what a correct solution will soon be forthcoming for a standard insulator for voltages of 75,000 and upwards. In fact, as noted before, the different manufacturers are now experimenting toward that end.

Looking over the history of high tension transmission, it is only about fifteen years since we looked with wonder on the Lauffen transmission line of 30,000 volts over 100 miles. To-day there are thousands of miles of long distance transmission at voltages ranging from 11,000 to 65,000 volts, and great credit is due the engineers who have designed and carried out this work in the face of almost insurmountable obstacles. The progress of high tension transmission has been very rapid, and in all of the various branches, with the exception of the line insulators, it is now possible to handle voltages in excess of 75,000 volts, there being no difficulty whatever in the designing and manufacturing of successful transformers and switchboard apparatus for these high potentials. It should be taken into consideration in the future designing and laying of transmission lines, the possibility of increasing the present voltage to the voltage that may be possible a year or more from now, so that large quantities of power may be economically distributed over long distances.

It has been demonstrated by practice that very large generating units can be successfully operated and that both steam turbine and hydro-electric plants can be operated successfully, and the one question to be decided is, how can large powers that are so successfully generated be distributed over long distances economically, taking into consideration the high price of copper and aluminum. The answer to this question is, by high voltages only. Up to the present time the commonly accepted form of insulator is what is known as the pin type, meaning by that an insulator having for its resting place a pin imbedded in, or fastened to, a cross arm; this pin being of wood or metal. Present practice has demonstrated that wood can be safely accepted for insulator pins up to 25,000 or 30,000 volts. Beyond that it is advisable, for mechanical reasons, to use malleable

*Paper read at the Annual Convention of the Canadian Electrical Association.

iron, but the so-called pin type of insulator has reached such dimensions, in the endeavor to meet requirements for higher voltages, that it seems to be the consensus of opinion of the leading high tension engineers that this type of insulator has reached the limit of good line construction, and, when one stops to think of the dimensions of an insulator used on a 60,000 volt transmission, one is inclined to think that the engineers are correct. Not only is it a difficult matter, from a mechanical standpoint, to find a pin that will take the necessary stress incident to an insulator of this large size and weight, but the problem of manufacture, from the standpoint of the pottery, is one that is exceedingly difficult, so that apparently it is necessary to make a radical departure from the present practice of pin insulation in order to take care of the various difficulties that are encountered in the construction of insulators for the higher voltages, and it is the belief of the writer, and also of other engineers, that a suspended form of insulator will be the type which will be used, it being, from a mechanical standpoint, a comparatively simple matter to suspend any desired weight, and, from an electrical standpoint, it seems possible to so design an insulator that it will be mechanically strong and a good dialectric as well.

The suspended type of insulator would have the advantage that ample arcing distance could be provided without making the insulator top heavy and difficult to manufacture. It should be so designed that arcing can not occur until the voltage is sufficient to rupture the air and cause the currrent to arc from end to end, this feature being of great importance where the insulators are mounted on steel towers, which is conceded to be the best engineering practice. On high valtage lines where steel towers are used the pin type of insulator for 100,-000 volts, or higher, would seemingly be almost an impossibility, owing to the size necessary to take care of the surges and other line disturbances and owing to the fact that the earth potential is carried into the head of the insulator by the steel pin and through the metal towers.

An ideal insulator, for all conditions of high voltage stress, should be one that would take care of climatic conditions, such as fogs, dust deposits, salt spray, etc., and should have as few still air spaces as possible. That is to say, it should expose a large part of its surface to the wind and should have a long leakage distance of small area. In the designing of a type of porcelain insulator for this class of work, it should be borne in mind that cemented parts, if there are any, should be under compression and not under tension, owing to the strains to which it may be subjected from expansion and contraction. There should be as few air spaces as possible to avoid the accumulation of dust, insects, etc., and there should be nothing but porcelain, well vitrified, between the points of opposite potential. Engineers are now at work along these lines, and, as the result, a number of plans have been proposed embodying more or less of these ideas, and it is only a question of a short time before the successful insulator will be evolved for these higher tensions: if it has not already come to pass.

Leaving for the time being the open question of extraordinary potentials, we will take up the question of high tension transmission as it exists to-day. Continuous operation of a transmission system is an absolute essential and depends to a large extent on the effectiveness of the insulator used. In this paper the writer only aims to discuss the qualities of porcelain insulators, as it is now generally conceded that porelain is superior to glass for the manufacture of high tension insulators, and, in fact, supersedes glass wherever the question of cost is not a paramount problem. In the designing of an insulator for any given voltage, and especially for the higher voltages, there are three considerations of primary importance: First, electrical design; second, the mechanical strength; and third, the quality of the material. In the electrical design consideration must be taken of the dialectric strength of the adjacent air, so that sufficient distance be allowed between the points at which the line voltage is impressed that it will not arc over to the pin or cross arm under ordinary working conditions. In other words, make the potential gradient as gradual as possible from line wire to ground. These points of impressed voltage may vary greatly in an insulator of poor manufacture, although of the same electrical design. For instance, in two insulators of the same general design and different manufacture, the one having the greatest electro-static capacity and, therefore, the greatest electro-static field, will suffer from brush discharge and arcing over sooner than one having less electro-static capacity and, therefore, less electro-static field. In another case, two insulators of the same design but of different manufacture, the one possessing a body of greatest density and which is the most vitreous, will carry ordinary working voltage and line disturbances with less trouble than an insulator that does not possess these qualifications.

Due care must be exercised in the manufacture of porcelain insulators to secure the necessary dialectric strength between the tie wire or top groove and the point inside the insulator which is in closest proximity to the head of the pin, providing that pin is made of iron, which is usually the case in voltages in excess of 30,000, and in many cases misfortune has come to the engineer who depended to a large extent on the pin and cross arm for additional insulating qualities. Practice dictates the fact that on the insulator alone should be the reliance of the engineer for his insulation, and all insulators, whether of porcelain or glass, should be tested with approximately three times the full line voltage brought to the inside of the insulator head, and the entire burden of correct and sufficient insulation should be placed on the insulator itself and a large number of line troubles would be prevented.

It has been the unfortunate habit of some engineers to consider the cost of the insulator of paramount importance, and, when one takes into consideration the importance of the insulators to the construction of a line, one is always led to wonder why, by the additional

cost of a few cents to each insulator, a reasonable factor of safety is not obtained. It is, however, pleasing to note that many engineers are profiting by the said experience of their brothers and are securing their insulators based on specifications that insure a reasonable factor of safety, and, in fact, are in some cases going to the other extreme and not only require the manufacturer to guarantee their insulators to stand a rigid test, both before and after erection, but in one case which the writer recently noticed an additional clause was inserted requesting the manufacturers to guarantee that the railroad would not break them in transit, which, we will have to agree, was rather a severe test.

Reverting once more to the electrical design, it is necessary in the design of an insulator that the factor of safety be sufficiently large so that the abnormal electrical strains that may be, and are, occasionally brought to bear, will not cause a puncture and consequently a shut-down of the line. For instance, an insulator designed to carry 50,000 volts should stand a dry test of approximately 150,000 volts, thus giving a fair factor of safety to enable it to withstand the possible surge voltages caused by short circuits, etc. This very fact of requiring a reasonable factor of safety in the electrical and mechanical design of an insulator has decided the limiting possibilities of the pin type of insulator as approximately 60,000 volts line voltage, as, to secure a factor of safety of three, it would be necessary to build an insulator of mammoth proportions and uncertain body, having a weight that is almost prohibitive to pin work. This brings us again to the conclusion that the only method of securing a proper factor of safety on the higher voltages would be to use a suspended type of insulator.

Having discussed the engineering design of a high tension porcelain insulator, the writer thinks it might be of interest to take up its composition and the difficulties of manufacture, concluding with the tests to which all insulators should be submitted before being placed on the line. The porcelain of which a high tension insulator is made is composed of certain proportions of English ball, China clay, some domestic clay, commonly called Tennessee, and some eldspar and quartz. The clay forms the body and gives the proper mechanical strength, while the function of the feldspar and quartz is to act as a flux and thoroughly permeate all the parts of the insulator, thus making a thoroughly vitreous mass when subjected to a sufficient heat. This mixture having gone through the various steps of grinding is forced through a filter of copper or silk cloth of 110 mesh to remove all impurities, and is then formed in the various shapes and designs suitable for the purpose for which it is to be used and placed in the drying room. After a sufficient amount of moisture has been removed in this way the insulators are dipped in the glaze solution and are again placed in the drying room, after which they are placed in the kilns and subjected to a heat approximating 2,700 degrees Fahrenheit. The function of the glaze is to give the insulator the necessary color and also a smooth, even surface, in order that dust and rain may be easily dispelled. Ordinary unglazed procelain would come from the kilns a pure white color with a comparatively rough surface, which would hold the dirt and moisture, so that it is necessary to glaze the insulator in order that a smooth, glassy surface may be obtained, as well as the desired color. If, in baking, the insulator is not subjected to the proper amount of heat the body of the clay will not be thoroughly vitrified. If, on the other hand, the insulator is subjected to too much heat the body of the clay will be porous. Therefore, it is necessary that the insulator be subjected to the exact amount of heat necessary to secure the desired results.

In determining the exact amount of heat to which these insulators shall be subjected, ordinary thermometers are not used, but a small carefully prepared cone of pre-determined composition is utilized, which is placed at intervals in the kilns and is observed through small orifices by the attendant. These cones assume an erect position under any degree of heat below the desired one. As soon as the pre-determined point has been reached, however, the cones melt and form glaze and at this point the heat is turned off and the ovens allowed moved from the kiln the insulators are then subjected to a most rigid electrical and mechanical test to determine their qualifications for the work which they are designed to do, and all those not coming up to the specifications should be rejected at this time. A certain number of all insulators coming from the kilns are subjected to two electrical tests, one a dry test to determine the dielectric strength of the porcelain body and the other a precipitation test to determine as nearly as possible the action of the insulator under most severe climatic nealed. This process cannot be hastened but takes a certain well-defined time for its operation. When reto slowly cool, so that the wire may be thoroughly anconditions.

The only objection that has been offered to porcelain as the composition of which the insulator should be made is the fact that in no other way than the above described can a porcelain insulator be properly tested, whereas the defects that might occur in glass can be detected by the eye. Unless an insulator is thoroughly vitreous and is practically non-absorbent and shows a fracture similar to glass, it is unfit for use under high potential stress. An ideal insulator would be one having a minimum amount of electro-static capacity with a maximum amount of mechanical strength, but in the pin type of insulator a strange phenomena exists, inasmuch as it is necessary to sacrifice one condition to some extent to obtain the other good points, and an insulator of successful design is one which appearance shows contains a happy medium.

The "Westinghouse Diary" for 1908 has reached us. It is a neat little booklet, strongly bound in black pebbled leather and containing, besides the customary space for memoranda and notes, a great deal of information valuable to the engineer and electrician.

*Analysis of Distribution Losses in a Large Central Station.

By E. L. Elden.

The central station system under consideration is typical of those in service throughout the country, and serving the larger centres of population and including adjacent suburban districts within a radius of upwards of fifty miles from the main generating station.

This system, as is the case with many similar systems, comprises the business of a number of companies that have been amalgamated into one large organization. This larger organization, with ts greater financial resources and highly trained administrative and engineering forces, has naturally proved better fitted to meet the demands for service arising from an area of 450 square miles, in which thirty cities and towns, having a population of 1,000,000 persons, are served by the system.

Of the 1,800 miles of streets included in the territory, 750 miles are covered by the lines of the system, which extend forty-three miles in a single direction from the generating station. The total fifty-watt equivalents connected to the system aggregate 1,600,000, equal to 80,000 kilowatts. This load comprises the usual mixtures of power, heating and lighting apparatus which constitute the business of a central station system. The maximum demand is approximately forty-four per cent. of the connected load at the time of the yearly maximum, and approximately twenty-seven per cent. during the average days of the year.

The generating equipment consists of two main generating stations, one generating three-phase, sixty-cycle, alternating current exclusively, and the other generating low tension direct current. In addition there are two small generating plants located at remote parts of the system, which are still in service independent of the main system. When convenient, these will be discontinued as generating stations and converted into substations supplied with current from the main generating station. To facilitate the distribution of current over the large territory, substations are maintained at suitable centres, at which points the high pressure transmission lines deliver sixty-cycle, three-phase, alternating current for conversion to direct current and alternating current at voltages suitable for commercial purposes.

Three transmission pressures are used, namely 2,300 volts, 4,600 volts and 6,600 volts. In explanation of the apparent complication of voltages in the transmission system, it was found more convenient and economical to maintain certain installations of underground cables and motor generators which were acquired in the purchase of another company's plant than to abandon the large investment represented by such equipment. All new installations are made at 6,600 volts, it being the intention gradually to eliminate the lower transmission voltages as conditions may dictate.

Throughout the entire system but three forms of service are supplied for commercial purposes; that is, either low tension direct current, single or three-phase alternating current.

The low tension direct current district, representing slightly less than one per cent. of the total area of the system, is supplied exclusively by three wire direct current at 115-230 volts. This is used indiscriminately for power, lighting and heating service.

Similarly, the alternating current district, embracing ninety-nine per cent. of the area, is supplied exclusively by the alternating current system of distribution. Three types of primary distributing circuits are used in the various substation districts according to the demands for service as follows:

(1) 2,300 volts, single-phase circuits in resident districts where only lighting and small power service is required.

(2) 2,300 volt, three-wire, three-phase circuits are used in districts of limited areas where mixed lighting and power service of considerable amounts are to be furnished.

(3) 2,300 volt, four-wire, three-phase circuits are used in districts covering large areas where mixed lighting and power service is furnished.

In each of these cases, however, service is furnished to the customers at 115-230 volts, single phase, for lighting and small power service, and 230 and 550 volts, three phase, for power service.

In addition to the types of service previously referred to for commercial service, there remains the street lighting service, which is supplied at 6.6 amperes direct current, or alternating current, for both series-arc and incandescent lamps. In one district 3.5 amperes series incandescent lamps are used, but this is not considered as standard, and is subject to change when convenient.

To place the system on the basis described above has not been so simple a procedure as may seem from a cursory reading of the preceding statements. With the acquisition of each new interest and its territory, it was found that special forms of service were being supplied to customers, in most cases differing from those which are now considered as standard. As a result, at one time in 1903 some twenty different forms of service were being supplied to customers, with the attending complications in operating. Special apparatus was maintained and operated to supply these different services, with results far from economical; and, while much of the apparatus in service was as modern as it was possible to be, some could scarcely be considered in that class.

It was apparent from a comparison of the kilowatt hours sold, with the kilowatt hours generated, that the difference was too great to be consistent with good practice. To ascertain the reason a complete survey of the whole system was undertaken with a view of eliminating the uneconomical features. This investigation involved an examination of each customer's connected load and

*Paper read before the Boston Branch of the American Institute of Electrical Engineers.

demand; the capacity of and demand on each transformer in the alternating current district; the losses in transmission lines, feeders and mains; the operation of all station apparatus; the accuracy of all recording meters—in short, all the details of the uses of current by the company and its customers. As a result of this inquiry it was deemed advisable to proceed with the necessary changes. These changes, which were commenced in 1903, affected the following parts of the system:

A certain district was specified in which no form of service other than the three wire 115-230 volt direct current service would be supplied. This made it necessary to transfer all the alternating current customers affected to the direct current system, remove all transformers in this district, and reconnect the alternating current mains as a part of the direct current system.

The 500 volt direct current service was abandoned, and all motors located in the direct current district were adapted for 230 volt direct current operation, while such as were outside of the direct current district were replaced by alternating current motors.

A number of new substations were installed in the direct current districts to provide for serving the rapidly increasing business of the company, and at the same time to reduce the excessive losses in feeders and mains by shortening and rearranging the distributing points of existing feeders, as well as the addition of new ones.

In the alternating current district secondary networks were installed and the number and capacity of transformers reduced, the total reduction in this case being thirty per cent. of the installed capacity. Changes in substation apparatus were effected by the introduction of new apparatus, all adapted to supply the standard forms of service.

The results of these changes may be seen by reference to the accompanying tables:

TABLE I.

Year ending June 30—			
1903	49,122,344	31,569,741	64.26
1904	57,531,315	37,220,199	64.67
1905	64,161,987	41,910,281	65.31
1906	74,582,311	52,003,000	69.82

TABLE II.

230 volt motor generator	31,331,406	25,803,990	82.4	actual
230 volt converters	30,004,639	25,803,990	86.0	assumed

Saved by the use of converters—1,326,767 kilowatt hours

TABLE III.

Distribution of current for the year ending June 30, 1906:—

Commercial sales	52,003,000	69.82	
Company use	2,774,383	3.72	
Total losses	19,270,616	25.87	
Unaccounted-for current	441,437	0.59	
Total generated	74,489,436	100.00	
Subdivision of total losses—			
Losses in station apparatus	10,586,117	14.21	16.6
Losses in inter-station transmission lines	2,920,653	3.92	5.92
Losses in feeders and mains	5,763,846	7.74	10.50
Total losses station apparatus and lines	19,270,616	25.87	

In Table I. it will be seen that there was an increase in four years of 5.56 per cent. in the sales as compared with the manufactured kilowatt hours. The result, however, is an average for the whole year 1906. For the last six months of the year the average was much higher, it being actually 73.65 per cent., this figure indicating future possible results.

Using the data for 1906 as given in Table I. as a basis, it will be seen that it would have been necessary to manufacture approximately 5,000,000 kilowatt hours more in that year to sell the same amount of current, if the conditions had been the same as existed in 1903. Further, if the average of the last six months of 1906 had been maintained throughout the year, a further saving of 5,000,000 kilowatt hours would have been made during the year. While the resulting economies have in themselves justified the time and outlay necessary to make the changes, the increased capacity of the system, as well as the simplifying of the operating conditions, have been results far outweighing all other considerations.

As it is the practice of this company to use motor generators in preference to synchronous converters, to transform the three phase current to direct current for the supply of service to the 115-230 volt, three wire direct current system, it may be suggested that a further economy could have been effected by the use of converters.

The motor generator equipment of the company comprises thirty-six units, having a total capacity of 10,210 kilowatts, and varying in size from the 1,000 kilowatt direct connected sets to the sixty kilowatt Edison bipolar belted units which have been retained in service in some of the smaller stations. In Table II. are shown the actual results of the operation of this apparatus for the year 1906. There are also shown the estimated results of the use of converters of the same sizes, operated in the same manner as the motor generators, and at an assumed efficiency calculated from the manufacturer's data on such sizes of apparatus.

The operating efficiency of the converters is estimated at eighty-seven per cent., less one per cent. for the current used by the cooling apparatus, while the efficiency of the motor generators was 82.4 per cent. The table shows a saving of 1,326,767 kilowatt hours by the use of converters, this representing the premium paid for the use of the more reliable apparatus, in addition to which there is to be added the slightly larger investment necessary in the purchase of motor generators. Owing to the well-known difficulties incident to the operation of sixty cycle converters in a large system where continuous service is placed above all other considerations, it is a question of individual opinion whether a company is justified in adopting either type of apparatus.

In the alternating current system the total losses, in-

cluding transmission, step-down transformer, distributing circuit losses, and meter losses, aggregate 41.1 per cent. equivalent to an efficiency of 58.9. Eliminating the losses in transmission lines, step-down transformers, regulators, boosters, etc., the total losses in the distributing circuits, meters, etc., aggregate 24.2 per cent., with a resulting efficiency of 75.8 per cent. from the substation to the customers' meters.

In the direct current system the total losses, including those in transmission lines, motor generators, tie lines, feeders and mains, meters, etc., aggregate twenty per cent., equivalent to a system efficiency of eighty per cent. Eliminating all losses in the direct current system except those which occur between the direct current switchboard in the substations and the customers' meters, a total loss of 7.54 per cent. is shown, or an efficiency of 92.46 per cent.

Two forms of street lighting service are in use, each involving the operation of different types of apparatus. In one case motor generators are used to convert alternating current to 6.6 ampere series direct current, and in the other case constant current transformers are used to obtain the 6.6 ampere series alternating current for similar service.

The total losses in the 6.6 ampere direct current system are 31.9 per cent., giving an efficiency of 68.1 per cent. For similar service from the alternating current system, the total losses are 15.2 per cent., with a resulting operating efficiency of 84.8 per cent.

The methods employed in preparing the data by means of which the losses in the system are determined may be understood by reference to Tables III., IV., V. and VI. These tables present a summary of the year's operation. Similar tables are prepared monthly which deal with the shorter period of time.

It should be understood that with the exception of such items in these tables as are preceded by an asterisk, all the data shown are the results of records taken from recording wattmeters. In such items as are excepted, computations were necessary, all of which were made from reliable data furnished by the manufacturer of the apparatus in question, supplemented in many cases by tests made by the company's representatives.

The losses in the individual commercial distributing circuits were determined by the drop-of-potential method, a constant being obtained for each circuit by taking a large number of pressure tests under all conditions of load. The losses in the direct current mains were estimated in the same manner. The losses in the street lighting circuits were calculated from the known length of the circuits, and these results further checked by voltage readings at the station while the circuits were in operation with a known number of lamps burning.

Every year the company makes thousands of tests of the meters in use on the customers' premises. For the year 1906 the results of all such tests showed that the average meter error was 2.6 per cent. slow. This factor has been used to account in part for some of the unknown losses, the total thus accounted for being approximately 1.5 per cent. of the total power generated.

Table III. shows, in the first part, a summary of the principal items without subdivision. The later part of the table subdivides the total losses in the system into divisions which are treated individually in the later tables.

In Table IV. the losses in station apparatus are subdivided and distributed among the various pieces of apparatus used in the operation of the stations.

Table V. indicates the losses in the inter-station transmission lines.

Table VI. shows similar data on feeders and mains.

(Continued on Page 28)

GRIN.

If you're up against a bruiser and you're getting knocked about—
Grin.
If you're feeling pretty groggy, and you're licked beyond a doubt—
Grin.
Don't let him see you're funking, let him know with every clout,
Though your face is battered to a pulp, your blooming heart is stout;
Just stand upon your pins until the beggar knocks you out—
And grin.

This life's a bally battle, and the same advice holds true,
Of grin.
If you're up against it badly, then it's only one on you,
So grin.
If the future's black as thunder, don't let the people see you're blue;
Just cultivate a cast-iron smile of joy the whole day through;
If they call you "Little Sunshine," wish that *they'd* no troubles too—
You may—grin.

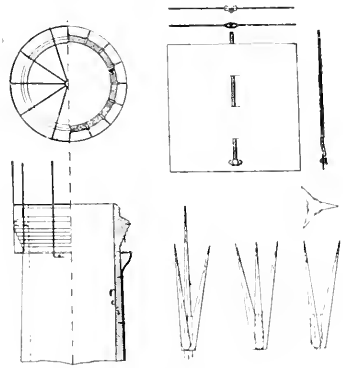
Rise up in the morning with the will that, smooth or rough,—
You'll grin.
Sink to sleep at midnight, and although you're feeling tough,
Yet grin.
There's nothing gained by whining, and you're not that kind of stuff;
You're a fighter from away back, and you *won't* take a rebuff;
Your trouble is that you don't know when you have had enough—
Don't give in.
If Fate should down you, just get up and take another cuff;
You may bank on it that there is no philosophy like bluff—
And grin.

—From "Songs of A Sourdough," by Robert W. Service.

LIGHTNING CONDUCTORS FOR HIGH CHIMNEYS.

In the last issue of the "Journal of the American Society of Naval Engineers," Dr. N. Monroe Hopkins, electrical engineer for consolidated power plants in the Navy Department, gives an account of some interesting experiments made to determine the behavior and effect of high-frequency discharges upon a model chimney.

A Tesla oscillator was used capable of striking through an air gap of 4 feet, and it was estimated that the model chimney and its conductors were subjected to electrical discharges at a voltage of 1,800,000 and a frequency of 200,000 oscillations per second. The results of the experiments appeared to show that a high chimney could be adequately protected from damage by lightning by the use of several conductors from the top equally spaced, and the employment of a copper spider on the top of the chimney connected to these conductors. The object of the spider is to prevent a stroke following a current of hot air into the chimney. The practical conclusions from the experiments follow, those relating



UNITED STATES NAVY DEPARTMENT, DETAILS OF LIGHTNING CONDUCTORS.

specifically to chimneys being in the form of specifications, which have been officially approved for the installation of lightning conductors on the brick power plant chimneys of the navy. The accompanying illustrations, Fig. 1, represent the top of the chimney, showing spider, and an eath plate and coat points.

For the complete protection of a central power plant, its roof and trusses, together with all other masses of metal without and within the building, should be metallically connected with chimney conductors as well as to conductors running along the top of all roofing and other prominent parts of the building. Sharp points should be placed at close intervals somewhat analogous to the protection afforded by the barbed wire netting used in Europe about the buildings of dynamite factories. As the architecture of the building must necessarily dictate the precise arrangement of conductors, the specifications given below pertain only to the protection of the chimney, which, if properly provided for, because of its towering height, affords also good protection for the building.

Chimney Protection for Power Plants.—Lightning conductors shall be laid up in the form of a seven-strand cable, and each strand laid up with seven copper wires of No. 10 B. & S. gauge. For chimneys of 50 feet and less in height, two lightning conductors shall be used. For chimneys over 50 feet up to and including 100 feet, three conductors shall be installed. For chimneys higher than 100 feet, four conductors shall be installed. All heights to be considered from ground level. All conductors or cables shall be symmetrically arranged about the chimney with one cable on the prevailing weather side of the chimney. Said lightning conductors or cables to be securely attached both mechanically and electrically to independent pure copper earth plates or bars. In cases where the chimney foundations have already been filled in, instead of earth plates, earth terminals may be used, composed of pure copper bars 3 inches by 1-2 inch by 3 feet. In all cases the lightning conductor terminals shall extend to the ground water level, and in no case shall they extend less than 15 feet from the ground surface. Earth plates shall consist of pure copper 3 feet by 3 feet by 1-8 inch.

Application of Conductors to Chimney.—Each lightning conductor shall be secured to the exterior of the chimney by means of bronze or brass anchors, without the intervention of any insulators or insulating material whatever. The brackets for attaching the ring or conductors to chimneys to be of high grade bronze or brass, and to be fitted with approved clamps for securely gripping said conductors and making good electrical connection therewith. The tongues or shanks of the anchors or brackets shall enter the masonry of the chimney a distance of at least 6 inches, and shall be at least 1-8 inch in thickness by 1 inch wide, terminating in a suitable head or angle, to prevent the anchor from being pulled out of the masonry. Anchors to be attached to conductors at intervals of not over 10 feet, and sweated to the conductors with solder at intervals of 50 feet. Conductors to terminate within 5 feet of the top of the chimney, and to be connected through the agency of suitable brass or bronze fitting and soldered to a 1 1-2 inch ring of copper attached to the periphery of the chimney by brackets spaced not over 2 feet apart; said brackets to enter the brickwork a distance of at least 6 inches and to be of approved design, with a tongue at least 1 1-2 inches in width and 1-4 inch in thickness, with a suitable angle or head to prevent pulling out. All joints in the said copper ring, as well as between the ring and conductor or conductors running down to the ground bars or plates, and including the latter, to be scraped bright, and, after making a secure mechanical joint, to be "sweated with solder." Said solder shall consist of one-half lead and one-half tin. All joints when finished shall be thoroughly washed off with water to remove every trace of soldering salts, acids or other compounds used. All joints secured by bolts or screws to be locknutted. In applying conductors where the chimney is already constructed, holes shall be drilled in the brickwork and said anchor brackets and anchors grouted in, the best Portland cement being used.

Terminal Rods for Lightning Conductors.—The copper ring shall be connected through the agency of clamps, insuring a good mechanical and electrical joint, with vertically-arranged copper rods, at least 3-4 inch diameter and 10 feet in length, the joints to be sweated with solder as before described. The copper rods to be placed equidistant around this ring, and supported in a rigid position vertically through the agency of additional anchors set in the masonry and a copper spider resting on chimney top. Rods to be arranged with a uniform spacing of practically 4 feet. This is taken to mean, for example, that 10 such vertical rods shall be provided for a chimney of 12 feet outside diameter of chimney at top.

Discharge Points.—Each rod shall terminate in a 2 point aigrette, each spur or point of this aigrette to be at least 3 3-4 inches long, the bases of which spurs shall be at least 3-8 inch in diameter, tapering to a sharp and well finished point; said aigrette to be provided with approved means to secure a strong mechanical and electrical joint with the vertical rods to which it is attached. The joints shall be sweated with solder.

Chimney Base Protection.—All lightning conductors shall be enclosed at bottom with a heavy galvanized iron pipe of 1 1-2 inches diameter, and extending 3 feet into the soil and 10 feet above. Said iron pipe to be provided with approved brackets to securely hold it to the chimney, the brackets not to be over 3 feet apart.

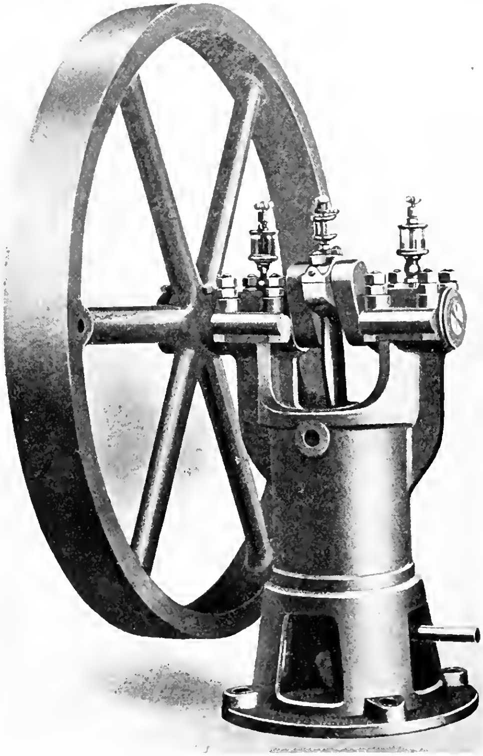
A NEW WESTINGHOUSE AIR COMPRESSOR.

The Westinghouse Air Brake Company have been for some years supplying various industries using compressed air, with their standard steam and motor driven air compressors. In a large number of industries, however, there is a demand for a compressor of smaller capacity. The company has therefore developed a small belt driven compressor, which has now been thoroughly tried out, and which it is prepared to manufacture in large qauntities.

The new compressor, which is a 3 by 4-inch belt driven unit, is characterized by the same superiorty of design and construction as the larger apparatus now standard in railway and traction practice and equally successful in commercial work. The weight of the complete unit is 218 pounds and its base is 12 inches in diameter. Its compact build enables it to be located in limited space wherever power from shafting or small motor drive is available. It is particularly adapted for gas engine starting, automobile garage use, charging storage tanks for small pneumatic tools, general machinery clearing and in a great variety of cases where compressed air at high or low pressures, but in small quantities, is required.

The compressor is of the vertical single-cylinder, single acting, water-jacketed type, operated by power delivered to a 30-inch fly wheel, attached to a crank shaft, the rotation of which drives the piston in the cylinder by means of a connecting rod. The diameter of the air cylinder is 3 inches, the stroke of the piston is 4 inches, and the rated capacity of the pump is 4 cubic feet of free air at 250 revolutions per minute. It will operate satisfactorily against any air pressure up to 250 pounds. At 250 revolutions per minute, its speed of maximum efficiency, and against 200 pounds air pressure, approximately one brake horse power is required to operate the pump.

Since the act of compressing always raises its temperature, the cylinder is surrounded by a water-jacket, through which a constant circulation of water is main-



New Westinghouse Air Compressor.

tained, thus lowering the temperature of the discharged air and increasing the efficiency of the compressor and at the same time greatly reducing the effects of overheating, due to prolonged operation.

A detailed description of the new compressor is to be found in a booklet just issued by the Westinghouse Air Brake Company.

ELECTRIC BRONZES.

We understand that the Midland Electric Company, D'Youville Square, Montreal, have just received per steamer "Mount Temple" twenty-three cases of French electric bronzes, slightly damaged, which they have placed on sale at less than cost. Any of our readers who are in the market for such goods would doubtless find it profitable to communicate with them.

TWO PRIMITIVE ENGINES.

By Henry A. Cozens, Jr.

A short time ago I came across a very interesting account of some of the earliest forms of the steam engine which someone else might be interested in, and I have written a short summary of two of Hero's engines.

Hero was no doubt the pioneer in steam and in steam engineering, and after experimenting with the expansive force of steam, made several devices embodying many of the principles of the modern steam engine. About 130 years before the birth of Christ, Hero designed and built an engine embodying the principle of action and reaction. This engine was the first example of the principle on which the steam turbine is based.

Referring to Fig. 1, into a closed vessel A, Hero placed some water which was heated by means of a flame F placed under the vessel, thus causing the generation of steam. From the opposite sides of the vessel were pipes P extending outward, all being the same length. Near the ends of the pipes, holes H were located on opposite sides. This part of the apparatus was mounted on a shaft S, bearing a pulley or some other means by which to transmit the power generated. When the steam was generated the machine began to rotate as the steam issuing from the holes pushed the arms backward. Hero's engine is not known in the world to-day as a practical unit for power purposes, and the nearest device that bears any relation to it is the automatic lawn sprinkler, which operates on the same principle, but uses water instead of steam as the power factor.

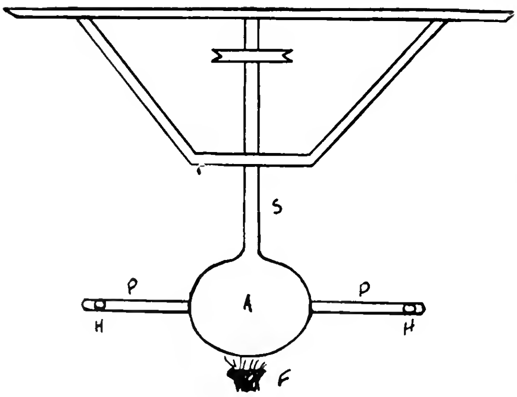


Fig. 1.

The principle of action and reaction, as demonstrated by Hero's engine, is accepted to this day and is used in connection with the numerous types of waterwheels and steam turbines, although steam instead of acting on the atmosphere acts against the turbine casing or against the blades of the wheel itself.

Another ingenious device attributed to Hero, in which the theory of expansion was used, might be termed the "Temple Door Mystery." The device was merely intended to make an impression on the people who worshipped in the temple and who thought it a miracle wrought by some superhuman being to see the temple doors open when a fire was built on the altar and the doors close when the fire was extinquished. It was not by means of steam but by air that the trick was accomplished, athough it demonstrated the principle upon which the first atmospheric or low pressure engine was based.

Referring to Fig. 2, A. is a hollow altar, constructed so that a fire may be built upon it, P represents a pipe

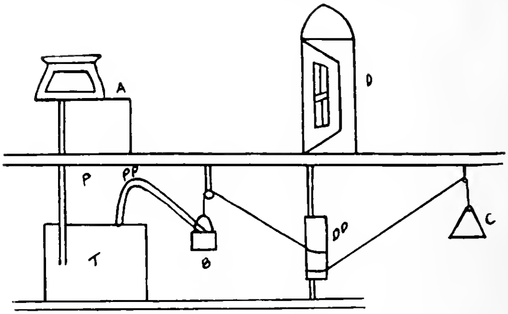


Fig. 2.

leading from the altar to the closed tank T, and PP a pipe leading upwards from the tank to the bucket B, which is suspended from a pully. The temple door D was attached to a drum DD, about which are ropes to the bucket and to the counter weight C. The action was as follows: When the fire was lighted on the altar the air contained therein was expanded and forced the water from the tank into the bucket, which, on becoming heavier than the counterweight, turned the drum and thereby opened the doors. When the fire was extinquished a partial vacum was caused in the tank and this sucked the water from the bucket back into the tank and the bucket, becoming lighter than the counterweight, caused the door to close. Since the machinery was all concealed under the floor the mystery appeared very great to the worshippers.

ENGINEERS' EXAMINATION.

The returns for the recent examinations conducted at Victoria by Mr. Baxter, senior inspector of machinery, at which candidates were trying for engineers' certificates, are now to hand, and the following were successful:

For second-class—J. B. Penty, Walter Cartlidge and W. Morell.

For third-class—O. Jacobson, W. Walker, A. C. Kick, J. McLaren, A. J. Taylor, R. Thurm, James Walker and C. Fox.

For fourth-class—T. Carey, R. Abram, T. Armstrong, J. Humphrey and J. D. Ross.

Second-class engineers are permitted to operate up to 500 horse-power steam plants; third-class up to 250 horse-power, and fourth-class up to 25 horse-power. A fourth may also act as second engineer up to 250 horse-power, and a third-class may act as second engineer to the higher powered steam plants.

QUESTIONS AND ANSWERS

GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS:

1. All enquiries will be answered in the order received, unless special circumstances warrant other action.
2. Questions to be answered in any specified issue should be in our hands by the close of the month preceding publication.
3. Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment should be placed in the hands of a consulting engineer, cannot be considered in this department.
4. To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possible doubt as to the information required.
5. In all cases the names of our correspondents will be treated confidentially.

Question No. 1.—Some incandescent lamps which I recently received have given trouble by burning out very quickly, nearly all showing a little crack on the side. Can you diagnose the trouble and suggest a remedy?

Answer.—Your difficulty is due, in all probability, to static electricity attracting the filaments against the glass. When the lamp is lighted the point touching the glass get burnt through. At the same time the hot filament very often cracks the glass, the fracture being generally known as a star-crack. This trouble makes itself felt more particularly at this time of the year, a cold dry atmosphere being very conducive to it, so much so that under such conditions the simple operation of pulling the lamp out of its cardboard wrapper, if done quickly, will generate enough static to pull the filament over hard against the bulb. Breathing on the lamps, or putting them in a warm room and sprinkling the floor with water, is the simplest remedy. The above of course assumes that your trouble shows itself when the lamps are first put on and not at some time afterwards. If the latter, as is often the case in dusty locations, such as wollen mills and woodworking shops, it probably arises from unusual charges of static being carried from the belts to the lamps by means of the dust floating in the air. In this case you can generally get over the difficulty by putting static combs on the biggest of the belts, particularly those driving dynamos. In addition to this it is sometimes necessary to use lower efficiency or higher candle power lamps, the filaments of which, being stiffer, are better able to resist the side strain.

Question No. 2.—Would you please explain to me what is meant by the impedance of a circuit, also, what is the power factor of a line containing two arc lamps, each taking 10 amperes and 300 watts, connected in series with each other and with a choking coil consuming 80 watts across 110 watts?

Answer.—The impedance of a circuit is that characteristic of an alternating circuit which corresponds to resistance in a direct current circuit. Thus in alternating work, instead of Ohm's original law, "Current = $\frac{\text{Voltage}}{\text{Resistance}}$" being true, you have to use "Current = $\frac{\text{Voltage}}{\text{Impedance}}$." In actual value it is equal to the square root of the sum of the squares of the reactance and the resistance, or "Impedance $= \sqrt{(\text{Reactance})^2 + (\text{Resistance})^2}$

(2) Your power factor is $\frac{300+300+80}{10 \times 110} = 61$ per cent.

Question No. 3.—Explain the easiest method of starting up gradually a 50 or 100 horse-power induction motor on 550 volt circuit in the event of the starting compensator being disabled.

Answer.—We do not know of any easy method under the conditions you name, because such a situation is generally very trying. If you have any other motors in the plant which are not materially smaller than the one with the disabled compensator, you could cut in a double throw switch between one of them and its compensator, arranging the wiring so that with the switch thrown one way the motor was connected to the leads coming from the compensator, and when the switch was thrown the other way the motor was connected directly to the 550 volt lines. This would enable you, after the motor had been started in the ordinary manner, to connect it to the mains and keep it running (by simply throwing the double throw switch) while leaving the compensator free. Then, if you connected the motor with the disabled compensator in the same manner, by means of a second double throw switch, you would be equipped to start either motor by the one good compensator. Failing this extra compensator, about the only thing you can do is to throw your motor straight onto the 550 volt line, though this could scarcely be called an easy start; in fact, you would probably have to reinforce all your fuses before you could get the motor started. Of course, if you are operating your own plant, you could bring the voltage away down on it before throwing in your switch, then raising it gradually would give a start that would be almost easier than with a compensator. If you had more than one motor you would need to start them all simultaneously, that is, leave all the compensators in the running position.

Question No. 4.—(a) In a three phase revolving field type synchronous motor, are all the armature coils subjected to the same potential strain?

(b) Is the result of making a bad short, when synchronizing an high voltage synchronous motor, injurious to the motor? Should high voltage synchronous motors be capable of withstanding this strain? Is the result any more injurious than a short circuit occurring on the power line resulting in the synchronous motor dropping out of step?

(a) Answer.—Provided that each of the three armature windings in a three phase machine is identical with the others, which is practically always the case, any and all coils are subjected to the same electrical and mechanical stresses. These stresses rise and fall simultaneously in all the coils composing any given phase, but they are not simultaneous as far as the three phases are concerned, those in phase B, for instance, being one-third of a cycle behind phase A, and phase C being yet another third behind phase B.

(b) Answer.—Yes, the effect is undoubtedly injurious, in that it puts on the motor very severe and abnormal strains, both mechanical and electrical. On the other

hand, all modern machinery is generally rugged enough to stand these without breaking down, though their effects can never be anything but more or less harmful, each repetition tending to shorten the life of the apparatus. Theoretically, the conditions you describe may not be quite as severe as a short on the power line, but we think that practically there would be very little difference between the two.

Question No. 5.—Would you please explain to me what is the meaning of the term "compensating voltmeter"?

Answer.—A compensating voltmeter consists of a standard voltmeter combined with an auxiliary piece of apparatus, called a compensator, the whole being arranged in such a manner that the voltmeter indicates the voltage at some distant point, and not at the point where it is located. The compensator is generally made adjustable, so that it can be set for a variety of lines, the length of the circuit, distance between wires, circular mills, etc., all affecting the setting; though once the adjustment has been made for any given line the voltmeter will read correctly under any and all changes of load, power factor, etc. The equipment is exceedingly valuable for use in power houses, where it is desired to know the voltage, not in the power house itself, but at the centre of distribution. It takes the place of the old pressure wire system, on which it is quite an improvement, as no extra lines are necessary, everything being placed directly on the switchboard.

ANALYSIS OF DISTRIBUTION LOSSES IN A LARGE CENTRAL STATION.

(Continued from Page 25.)

The preparation of these data involves the labor of one man for a period of approximately one week each month. It is his duty to watch the operation of the system through the statistics furnished him by the operating and sales departments, comparing them with data which have been prepared representing the possible maximum conditions of efficiency of operation of every piece of apparatus and reporting for investigation any divergence from the estimated average operating losses. Curves are prepared monthly which show the percentage of losses in the current handled by each motor generator, storage battery, balancer, booster, exciter, step-down transformer, constant current transformers, or any other station apparatus, thereby providing means for immediately detecting any unusual results, and furnishing an invaluable check on the operation.

Aside from the value which these data may have from an operating point of view, it is of considerable interest in indicating the characteristics of each district as a revenue producer, thus making it possible to judge accurately of the advisability of making extensions for the different classes of service.

If there should be undertaken at this time the construction of a generating and distributing system similar to the one under consideration, the installation would be made under conditions which would eliminate the disadvantages encountered in reconstructing existing equipments, as in the present case. This would be particularly true in certain parts of the country, where the limitations placed by the local authorities on permissible operating conditions are less severe, and where the quality and the continuity of the service are not of such paramount importance—all conditions tending to greater economy and reduction of operating losses than is possible in the present system.

TABLE IV.

Losses in station apparatus for the year ending June 30, 1906:—

230 volt motor generators	5,527,416	7.42	17.6
500 volt motor generators	373,059	0.50	33.6
Series arc motor generators	2,403,471	3.22	25.5
Step-down transformers	1,010,848	1.36	3.23
*Constant current transformers	118,548	0.16	5.40
*Potential regulators	65,353	0.09	3.53
Batteries	807,067	1.09	43.2
Boosters	211,264	0.28	63.0
Balancers	67,725	0.09	
Water rheostats for testing	1,366		
Total	10,586,117	14.21	

TABLE V.

Losses in inter-station transmission lines for the year ending June 30, 1906:—

3 phase 2,300 volt lines	1,556,981	2.09	8.41	24.8
3 phase 4,600 volt lines	98,813	0.132	1.52	8.7
3 phase 6,600 volt lines	770,577	1.04	3.55	29.1
230 volt direct current tie lines	494,282	0.66	18.30	3.6
Total	2,920,653	3.92	5.92	

TABLE VI.

Losses in feeders and mains for year ending June 30, 1906:—

*2,300 volt commercial lines	1,854,854	2.50	25.1
230 volt d. c. feeders	1,901,948	2.55	4.93
*230 volt d. c. mains	641,343	0.86	2.00
*500 volt d. c. feeders	74,466	0.10	9.15
*Street lighting circuits	809,103	1.08	9.53
*Meter potential losses	482,132	0.65	
Total	5,763,846	7.74	10.5

POISONING FROM MOTOR GASES.

A curious and interesting fact regarding what may be called "Automobile-poisoning" has been recently communicated to the Paris Society of Legal Medicine by Mr. Marcel Briand, as reported in "La Nature" (Paris, November 16th). Says this paper:—

"The waste gases are capable, if the journey is a long one, of producing real symptoms of poisoning. Some automobilists have actually been obliged to give up their favorite sport because of the gases which, penetrating in small quantities even to the interior of the vehicle, cause them presistent trouble. The waste gases not being adapted for contact with our bronchial tubes, it is proper to notify the automobile-makers that the floors of their machines should be made as tight as possible, in order that passengers may be protected from these products, which may, at the very least, cause distressing headaches."

SCIENCE STUDENTS HOLD ANNUAL BANQUET

The nineteenth annual dinner of the Faculty of Applied Science, Toronto University, which was held on the evening of December 6 last, proved to be a most representative and enjoyable function. Amongst those present were: President Falconer; Dean Galbraith, who had recently returned from Quebec, where he had served on the Bridge Commission; G. W. Gibson, Deputy Minister of Mines, Dr. D. J. Goggin, of the Ontario Department of Education, Professor DeLurry, City Engineer Rust, and many others, prominently identified or allied with engineering interests.

Responding to the toast of the University, President Falconer touched briefly upon the ethics of the profession and made special allusion to the great responsibilities of its members in their relation to human life. The president also emphasized the need of perfect self-control in the carrying out of big projects which involved the direction of large bodies of men.

Dean Galbraith, in his reply to the toast of the Faculty of Applied Science, touched upon the serious consequences attendant upon engineering miscalculations; loss of life entailing sorrow and bereavement, such as that with which he had lately come into contact at the Quebec enquiry. Referring to the expansion of the Faculty at the University, the Dean urged the raising of funds for new buildings, and showed the great returns in the development of the Dominion resulting from such expenditure.

The wisdom of encouraging technical education was also dealt with in an interesting speech by Dr. Goggin, who quoted the commercial success of England, Germany and Belgium, whose policy has been to increase their facilities to the utmost. Dr. Goggin traced the decrease of emigration in Germany to this source.

Deputy Minister Gibson outlined the important part played by engineers from the very earliest history, and remarked the great influence of science upon the nations of the past.

Professor De Lury in a bright and pleasing speech in reply to "Canada and the Empire," championed the cause of unity and urged those present to work hand in hand with the mother country and to benefit from her greater experience.

The proceedings of the evening were enlivened by an orchestra and by some light selections rendered by the S. P. S. quartette.

ELK RIVER FALLS.

(The Cranbrook Prospector.)

In such a district as Southeast Kootenay, with its enormous natural resources of mineral and timber one is apt to pass over a smaller asset such as a water power with but a casual glance, without realizing the extraordinary waste of a power that in the future must form a centre of commercial activity.

Such a power is that known as Elk River Falls, situated at the mouth of the Crow' Nest Pass, and at present running to waste some tens of thousands of horsepower, although contiguous to two lines of railway.

Here we have an ideal spot for a huge industrial centre that should include commercial enterprises of every description, and form the nucleus of a large town upon a firm and lasting basis. When one takes into consideration the advantages that are really in evidence and the necessities of the district, it is a matter of genuine surprise that capital has not seized upon it as an asset of incalculable value.

As before mentioned, served by two railways, illimitable coal areas within an hour or two's haul, situated in a mining country where large deposits of silver-lead and copper are being worked, big bodies of hematite within ten or a dozen miles, timber everywhere, a growing country and an increasing Western trade and still—an idle water power. Why is this? The only answer that suits the case is the want of judicious advertising amongst the class that could handle such a property. To a comparatively poor man it is valueless, but to a vigorous company it is invaluable, and it would mean to the country such a forward movement as no other operation could effect.

It cannot be much longer before some effort is made to utilize this enormous power which is formed by the whole of Elk River (no inconsiderable fork of the Kootenay), falling 150 feet or more in the space of one mile, and in one place a sheer drop of 50 to 60 feet.

There are two prospective railways to serve this locality, and when built will form an irresistible array of advantages. The location itself is excellent, and the immediate country for mills, townsites, etc., is perfect; open flat benches of no great height with wide stretches of open country.

Spokane is the nearest approach to it in its water power and locality, but without the advantages of Elk river included in the close proximity of the coal.

GAS GENERATED BY ELECTRIC LEAKS.

Investigating a leakage of current from the negative cable of an electric tramway in Liverpool, Dr. Bassett has found that the top of the wooden trough carrying the cable had been burned through and material had wire. Hydrogen was given off on contact with water, leaked in that had formed a hard alkaline crust on the suggesting the presence of free sodium and potassium. A fluid alloy of these two metals was discovered in interior crevices, and analysis showed that the crust was silica and about one per cent. each of free potassium two-thirds sodium and potassium hydroxides, the remainder being mostly earthy matter, with some soluble and free sodium. It was concluded that electroysis formed the free alkali metals, which water converted into hydroxides, with the evolution of hydrogen. If confined and mixed with air, the hydrogen might have produced a violent explosion, and this suggests a new explanation of explosions near electric mains that have been usually attributed to coal gas.

MILL WASTE FOR ILLUMINATING.

If pending negotiations and experiments are successful mill waste and sawdust, the burning of which has long been expensive and difficult, will hereafter be utilized in the manufacture of fuel and illuminant. A process invented and patented by J. Russel Coutts, for producing gas from straw, sawdust and other mill refuse, will probably be adopted by the Vancouver Gas Company, for the requirements of the city of Vancouver. Mr. Coutts, the inventor, is a science graduate of McMaster University, Toronto, and his process has been adopted in two or three towns in the Canadian northwest, where straw from the wheat fields will be used.

The process, which is patented in the United States, Canada and other countries, is controlled by a company in Cleveland, Ohio. Contracts have been made with thirty towns for the installation of gas producer plants under the new process, the places being in the grain growing belts of Canada and the United States. An expert from Cleveland will be in Vancouver soon to prepare estimates of the cost of installing the plant.

The vast possibilities in manufacutring and in securing cheap fuel and illuminant from mill waste are extremely alluring in the milling centres of this coast. Mr. Coutts, who visited Vancouver a few days ago, in discussing the matter said:—

"Coal for making gas, ranges from $4.50 to $6 a ton in this locality. The mill waste can be had virtually for the carting, and the quantity available is unlimited. The cost of producing gas from such material will be 50 to 75 per cent. less than from coal. The reduction in price of gas will increase the consumption many hundreds per cent., as well as enable the poorest people to adopt gas as a fuel. The possibilities of gas for power purposes is another feature of great importance, but the strongest feature of the gas produced by this process is its high calorific quality and illuminating power. It is superior to coal gas which, with over twenty candle power illuminating value and 600 units of heat a cubic foot, has hitherto been considered the standard. The new process can be adapted at small cost to existing coal plants, the holders, services and mains remaining unchanged. All that is required is a slight modification of the retorts at trifling expense."

As the board of directors of the Vancouver Gas Company is a London, England, body it will be considerable time before the matter can be laid before them fully and decision reached.

RESTORE CONFIDENCE THROUGH ADVERTISING.

The best manner in which the manufacturer and jobber can show his confidence in the financial and commercial situation of this country is to begin an advertising campaign in the very first week in January. Nothing can be more stimulating than advertising. You may not have the goods to sell, you may wish to curtail credit, but advertise all the same. Keep your goods before the trade. A break in the chain is disastrous. If a merchant slackens on his advertising his present customers or his prospective patrons will come to the conclusion that his business is weak, while so long as he hammers away enthusiastically at a publicity campaign he gives the impression that business is booming with him, and fixes himself in the eyes of the trade as a man of push, enterprise and progress.

Make the good times yourself. Restore confidence by being confident. The best method is by bright, cheerful advertising. Don't go around with a long face, with "blue" stories of "up against it," "down and out," etc., or people will be afraid to do business with you. If every jobber and manufacturer were to begin an advertising campaign in January and announce that the depression had passed, we venture to predict that in a short time an atmosphere of cheerfulness and confidence would be restored to the most gloomy in the land. No man is more constantly unhappy, or succeeds in making others so, than the pessimist. He is out of harmony with things. He loses the true dignity of life.

If every business would go to work with a will to convince its customers that there is no real cause for suspension of business, confidence would be restored almost immediately.

REMEDY IS IN THE HANDS OF THE BANKS.

In a general review of the financial situation in the United States the "Southern Lumberman" says:

"One thing is certain, all the money that is not in the banks as reserves is in the hands of individuals who are hoarding it out of fear that conditions will get worse than they now are. This is a fear that certainly cannot be dissipated by the banks joining in the hoarding. Unless something is done, conditions will get worse, and in our judgment, if present conditions are much longer continued, the banks will find very soon that their reserves, instead of being conserved or increased, will begin to diminish. Liquidation has gone about as far as it can go until some measure of business is resumed, unless the property of the people is to be sacrificed at prices so low as to draw money from these hoarders—and this means practical bankruptcy for thousands of concerns. Property that has no value to command credit has but a small value at a sale.

"The banks of the country were very urgent in their plea that their patrons display patriotism and fortitude, and patience were manifested in a remarkable degree. All sorts of inconveniences were cheerfully submitted to, and anything the banks said was accepted and lived up to. It is not too much to say now, however, that the business people are growing very restless. They want to see something of a spirit of reciprocity on the part of these banks that have got the money. They think the situation in a large measure is squarely up to the banks, and that it is for them to say whether or not improvement shall come, and when."

Such also is the situation in Canada.

SPARKS.

R. A. Brown, late of Calgary, Alta., has secured the position of city electrician at Nelson, B.C.

A 200 horse-power producer plant is being installed by Goldie & McCullough, of Galt.

The Hydro-Electrical Construction Company, of Toronto, have been awarded the contract for the proposed plant of the Minnedosa power company at $80,000.

Another stage in the evolution of electric power in the city of Guelph, Ont., was recently completed when the preliminary line of the power route was surveyed through the city.

Negotiations have been opened up at Claresholm, Alta., with a view to the acquisition by the town of the electric lighting plant owned by Cook & Hermon, and a by-law to this end will be prepared.

The British Columbia Railway Company have staked rights on the Jordan river, Vancouver Island, with the intention of supplying power for lighting and other purposes. It is anticipated that at least 20,000 horse-power will be obtained.

Lymburner, Limited, a new electrical engineering concern, have been incorporated at Montreal, Que., with a capital of $75,000. They have taken over the business formerly carried on under the style of L. A. Bonvier. Amongst the incorporators are L. M. and H. N. Lymburner, Joseph Rivet and J. A. Boisvert.

A proposition was recently made to the city council of London, Ont., by the Colonial Engineering Company, Limited, of Montreal, offering to install a producer gas engine plant to generate electricity so cheaply that the council would get a reduction of more than $40 per light per annum.

At Port Arthur, Ont., the city council are considering a proposition of the Kaministiquia Power Company to supply 200 horse-power electrical energy at $25 per horse-power per year. A clause was inserted which debarred the corporation from using the power for any other purpose than the operation of the street railway but this will be eliminated if the proposal is adopted.

In connection with the mammoth plant which is just being installed by the British Columbia Electric Railway Company at Lake Buntzen it is interesting to note that nearly half a million pounds of new machinery have been required in the equipment of the plant. Upwards of $2,000,000 have been expended on these works and further improvements are yet to be made.

At a meeting held a short time ago at Toronto, the Dominion Marine Association passed their unanimous condemnation upon the proposal to dam the St. Lawrence river at Long Sault Rapids. The association contend that the building of dams at this point will completely block the river and permit navigation only by means of locks. It is possible that an engineer will be appointed to look after marine interests in this project, but in the meantime the association have duly recorded their disapproval of the whole scheme by adopting an adverse resolution to send to the Government.

The Drummond Mine Company, who are going to develop important properties at Londonderry, N.S., have obtained permission to develop power on the Nepisguit river.

A rumor is current in Quebec City to the effect that a wholesale consolidation of local electric, gas and traction companies is taking place which will produce a powerful concern capitalized at $20,000,000. It is reported to be the intention of the new company to at once construct the Quebec and Saguenay Railway, and possibly an additional track or their own in this city, along the river front. All arrangements are understood to have been made towards securing electrical power for the line to Murray Bay, and other large works are to be established, one of which is a large car building industry.

Ross & Holgate, the well-known electrical engineers of Montreal, reporting upon the cost of the construction and operation of a municipal lighting plant at Montreal, say that the city would need to rebuild the present incinerator plant at a cost of $102,960. To this would be added the cost of an electrical plant, at $182,110, making a total capital cost of $285,070. The operating cost would be $65,145, from which would be deducted the expense of operating the present incinerator, amounting to $13,324, leaving a balance of $51,819. The city would have at its disposal 330 horse-power during twelve hours of the day, which, valued at $30 per horse-power, would amount to $9,900. Deducting this from the foregoing, a balance of $41,919 would remain as the cost of lighting. This distributed over 733 arc lights would give a cost of $57.18 per light. The city now pays $60 a light. The engineers conclude that the garbage of the city has more than sufficient heat value to generate all the power required for its lighting.

SPARKS.

The Calgary Power & Transmission Company have obtained the contract for supplying their city with power for a period of five years.

Two electric pumps will be required in connection with the installation of a water system at Dominion, N.S. The estimated cost of the whole project is $26,000.

A new power station is about to be installed at Edmonton, Alta. They will build six miles of transmission line, and will require line material and other equipment. Particulars may be obtained of R. R. Keely, City Engineer.

The Ottawa city council have decided not to submit the metropolitan power by-law to the property owners. This development follows an intimation from the company that they could not accept a lower price than $200,000.

St. Catharines' city council have accepted the tender of the Falls Power Company to light their streets for the next twenty years at $39.50 per lamp. An offer of $45 was submitted by the Hamilton Cataract Power Company, who had hitherto been charging $72.50.

The Granby Consolidated, owning extensive mines at Grand Forks, B.C., and the greatest copper smelting works in Canada, re-opened last month. According to the statement of J. P. Graves, the general manager, the capacity of the smelter will be greatly increased during the next few months.

Announcement was made a short time ago by Rodolph Forget to the effect that a large English concern are contemplating the expenditure of $10,000,000 in the development of Canadian electrical railways. The scene of tne most important operations will be the Island of Montreal. The company will assist in developing the plants of the Montreal Light, Heat & Power Company, the Quebec Railway, Light & Power Company, and the Electric Development Company, and electric railways will be constructed in the rural districts of Ontario and Quebec. Engineers have already completed their tour of inspection.

An important addition to the profession at Toronto, Ont., is made by the incorporation of Lewis & Smith, Limited, electrical, mechanical and civil engineers, and contractors. The capital of the new company is $100,000, and the incorporators include Harlow Lewis, H. W. Wilcox and C. M. Doolittle, all of Hamilton.

The transformers and instruments at the Cataract Power Company's substation at Irondale, Ont., were badly damaged by fire last month, and it is estimated that a loss of $10,000 was sustained. It is supposed that the blaze started from a short circuit. The car service at Hamilton was stopped for over an hour and several of the big stores were plunged into darkness.

Objections to the winding-up of the Stark Telephone, Light & Power System, of Toronto, are being made by the Coupon Securities Company, who are holders of $30,500 worth of the total issue of the $400,000 debentures of the Stark Company. An order was sought by the Coupon Company, and granted by Chief Justice Mulock, K.C., appointing Mr. E. R. C. Clarkson receiver and manager, and allowing the raising of $5,000 to keep the Power Company running for two or three weeks. It was stated that the monthly income of $4,000 was sufficient to cover the running expenses for that time. Affidavits were filed showing that the interests of the Coupon Company would be imperilled by a forced liquidation.

MOONLIGHT SCHEDULE FOR FEBRUARY.

Date.	Light.	Date.	Extinguish.	No. of Hours.
Feb. 1	5 40	Feb. 2	6 20	12 40
2	5 40	3	6 20	12 40
3	5 40	4	6 20	12 40
4	5 50	5	6 20	12 30
5	5 50	6	6 20	12 30
6	5 50	7	6 20	12 30
7	10 10	8	6 20	8 10
8	11 20	9	6 20	7 00
10	0 20	10	6 20	6 00
11	1 20	11	6 20	5 00
12	2 10	12	6 10	4 00
13	3 10	13	6 10	3 00
14	4 00	14	6 10	2 10
15	No Light	15	No Light	
16	" "	16	" "	
17	" "	17	" "	
18	6 00	18	8 30	2 30
19	6 00	19	9 30	3 30
20	6 10	20	10 30	4 20
21	6 10	21	11 30	5 20
22	6 10	23	0 30	6 20
23	6 10	24	1 30	7 20
24	6 10	25	2 40	8 30
25	6 10	26	3 50	9 40
26	6 10	27	4 50	10 40
27	6 20	28	5 50	11 30
28	6 20	29	5 50	11 30
29	6 20	Mar. 1	5 50	11 30
		Total	....	203 30

MOONLIGHT SCHEDULE FOR MARCH.

Date.	Light.	Date.	Extinguish.	No. of Hours.
Mar. 1	6 20	Mar. 2	5 40	11 20
2	6 20	3	5 40	11 20
3	6 20	4	5 40	11 20
4	6 20	5	5 40	11 20
5	6 20	6	5 40	11 20
6	6 20	7	5 40	11 20
7	10 00	8	5 40	7 40
8	11 10	9	5 40	6 30
10	0 10	10	5 30	5 20
11	1 00	11	5 30	4 30
12	1 50	12	5 30	3 40
13	2 30	13	5 30	3 00
14	3 15	14	5 30	2 5
15	No Light	15	No Light	
16	" "	16	" "	
17	" "	17	" "	
18	" "	18	" "	
19	6 40	19	9 20	2 40
20	6 40	20	10 20	3 40
21	6 40	21	11 30	4 50
22	6 40	23	0 40	6 00
23	6 40	24	1 40	7 00
24	6 40	25	2 50	8 10
25	6 50	26	3 50	9 00
26	6 50	27	4 40	9 50
27	6 50	28	5 10	10 20
28	6 50	29	5 10	10 20
29	6 50	30	5 00	10 10
30	6 50	31	5 00	10 10
31	6 50	Apr. 1	5 00	10 10
		Total	....	203 15

CANADIAN
ELECTRICAL NEWS
& ENGINEERING JOURNAL

PUBLISHED ON THE TENTH OF EVERY MONTH BY

HUGH C. MACLEAN, LIMITED,

TORONTO, CANADA.

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362

MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative

WINNIPEG - - - - - - - Telephone 224. 330 Smith St.
ROLAND F. HILL, Representative

VANCOUVER - - - Telephone 2248. 615 Hastings St.
GEO. A. GALL, Representative

ADVERTISEMENTS.

Advertising rates sent promptly on application Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.

The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

A New Type of Insulator.

With the increasing cost of coal, and the probability that it will always tend to creep higher and higher, every water power becomes more and more valuable. In view of this efforts are constantly being made to improve the methods of transmission, so that not only may the commercially possible range of a given power be extended, but also that improved service may if possible be given to the district already supplied. The main method of accomplishing this is by raising the voltage, but as the limit seems to have been reached with the present design of insulator, it would appear as if we could not get beyond the present maximum potentials of 60,000 to 70,000 volts unless a radically different design be introduced.

That this is entirely likely to be the case is evident by the way in which the suspension or link form of insulator is being offered as a satisfactory device for the higher potentials and heavier mechanical strains incident to the largest and longest transmissions lately proposed. This form has been offered, not because the ordinary style could not be built of any electrical and mechanical strength desired, but because the strains produced by the largest such insulators were too great to be withstood by any but extremely costly and cumbersome construction of pin, crossarm, and tower. In other words, it is really not the insulator itself, but its supports, which have called the halt. The new form, being designed to swing freely from a top support, instead of being held rigidly from an immovable base, obviously gets rid of all twisting strains, besides which any unusual stress distributes itself very much more easily than if the insulator were not free to move. In this way sudden shocks and strains are avoided, which will undoubtedly tend to increase the life of the tower, as well as the insulators.

The performance of the new design will be watched with great interest, because if it turns out as satisfactorily as expected it will undoubtedly revolutionize heavy line construction. Two or three large installations in the States are already being equipped with it, and in fact its possibilities appear to be such that it is already being seriously considered, so we understand, for use on the proposed transmission lines of the Hydro-Electric Commission, the potential to be something over 100,000 volts.

In addition to being a design which is apparently going to make a very material change in ordinary line construction, the new insulator is probably destined to play quite an important part in the matter of guying. As is well known, it has heretofore been an exceedingly difficult matter to make a strain insulator which was good both mechanically and electrically, surface leakage in wet weather being the main difficulty. The link or suspension type, however, lends itself very readily to the modifications required to make a strain insulator, the design being so good that it will not unlikely supersede most of the present forms.

Accidents and their Attendant Responsibility.

If an accident were to occur tomorrow on one of your lines, would the materials employed and the way they were erected and maintained bear the close scrutinty of the plaintiff's solicitor and the expert advice with which he would arm himself? Are your circuits all in good repair, free from broken patches in the insulation, from guys that can be reached from the ground, from primary and secondary so secured, or rather unsecured, that almost any slight disturbance will bring them together? Have you taken counsel with your mutual friends, the telegraph and telephone companies, and seen that none of their equipment is in danger of touching yours? In other words, have you carefully and systematically gone over your street wiring, foot by foot, to see that it is in proper shape, and that it in all ways conforms to the methods and practices that are considered, by general usage, to be safe and substantial? If you have not, and we are very much afraid that the majority of the answers would be no, we cannot urge upon you too strongly that you do so at once. Further, if you are not entirely satisfied with your own ability to do the work, why not get a consulting engineer to help you. His trained eye will doubtless discover many points that might escape you, and the advice that he will give you

will without doubt be one of the best investments you ever made.

For instance, did it ever strike you that those primaries were only 18 or 20 inches apart, in spite of being next the pole, and thus being wires through which a lineman would once in a while have to go? Where would you stand in a court after that had been proved. Did you ever reflect that the use of No. 10 wire for series arc circuits, with spans of 170 to 180 feet to boot, would leave you without a leg to stand on were it proved that that was the wire which broke and caused the accident Did it ever occur to you that some day you might bitterly regret the absence of that secondary ground wire which you were always going to install—but didn't? Why not get after these matters at once, and see that your outside equipment is beyond reproach? There are various standards to guide you on all points, such as the Underwriters' Code, the Institute Standards, and common or trade practice. The ability to claim and prove that you are in all respects up to what is considered good practice, even though it now cost a few hundred dollars to put you in that position, may later on save you from a damage suit for as many thousands. Delay is about as dangerous in this matter as it can be in anything, and so we cannot too strongly urge that you take the matter up at once, going without hesitation to a consulting engineer if you have any doubt whatever as to the fitness of your own staff. It is no reflection on you or your assistants to do so, as such work really requires a specialist, and there is not the slightest doubt but that you will have every reason to congratulate yourself on the results of your investment.

Develop Your Small Motor Business

At the present moment there is such a very wide discussion going on in Ontario, particularly through the Toronto-Niagara district, regarding cheap power and its desirability, that there appears to be more or less danger of our losing sight of what are really the most valuable attributes of electric power, namely, its great convenience and reliability. Of course, cheap power, speaking generally and without reference to other surrounding conditions, is always desirable, particularly to the larger consumer, but still is it not possible to overrate the value of cheapness at the expense of other features which at least are really equally valuable, and thus present the electric motor in a much less favorable light than that which rightfully belongs to it? As an instance, witness the figures which just now are being quoted as the results obtainable from internal combustion engines, all points relating to convenience, safety, etc., being made subservient to the one feature of cheapness. This is an error to which we are all more or less prone, and one which undoubtedly proves a hindrance to a great many operating companies when making a campaign for small motor business, unless care be taken to put the matter in its true light.

There is without question a very large small motor business still undeveloped among small manufacturers, repair shops, etc., which output can doubtless largely be secured by laying before prospective purchasers the proposition that, while they all desire cheap power, they need even more that reliability, simplicity, and convenience which can be furnished to the highest degree by nothing but the electric motor. In the first place, this form of motive power allows the location of small factories without regard for the presence or absence of a more or less cumbersome steam engine, or a heavy and inaccessible line of shafting, thus your workshop may be placed in a clean airy room, instead of having to go into some dark and disagreeable den because there only can the necessary power be found. Then again, a suitable room chosen, there is nothing to prevent the equipment being located to the best advantage if electric drive be used, because if direct connected the various machines can go anywhere desired, or if grouped, the necessary shafting and belting is comparatively light and unobtrusive. Then again, supposing you need to alter or enlarge your equipment, and who does not hope to have to do that some day, the ease and facility with which the changes can be made in an electrically driven shop, as compared with one dependent on a line of heavy shafting, are self-evident. Then when it comes to a question of cleanliness, to the ease with which power can be obtained at any instant of the twenty-four hours, and to reliability, the electric motor supplied from a modern central station is simply beyond comparison. Besides, all these points there is the question of safety, both to life and to property, regarding which practically nothing need be said. Then, referring again to the question of cost, while it is perfectly true that in certain cases steam or gas power will be the cheapest, still for the average small user it will generally be found that the electric is even on this point the most advantageous, because the introduction of other types of motive power very frequently demands more attendance than is necessary with the electric motor. Central stations undoubtedly have the best proposition which can be offered the small consumer of power, and a campaign amongst prospective users, setting forth the superior cleanliness, convenience, and safety of the electric motors as compared with any other source of power, all of which advantages are available at a moderate cost, will surely produce very satisfactory results.

POWER FOR PORT ARTHUR.

The council of Port Arthur have recently completed arrangements with the Kaministiquia Power Company for the supply of 700 horse-power to be used for lighting and the operation of their street car system. Their increased requirements for power and the failure of water supply from their storage resources in connection with their power plant have made it necessary for them to obtain outside power. The Kaministiquia Power Company have been for some time past supplying power to the town of Fort William, the Canadian Pacific Railway, the Ogilvie flour mills, the Canada Iron Foundry Company and others.

The Windsor, Essex and Lake Shore Railroad*

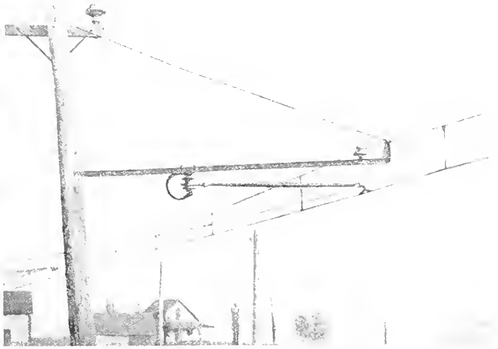
The first single-phase electric railway to be built and operated in Canada is the Windsor, Essex & Lake Shore Rapid Railway, which ran its first car in September of last year. This road is of particular interest to electric railway engineers and operators on account of the use of 3-wire single-phase generators for supplying current to both a 6,600-volt trolley circuit and a 1-wire 12,300-volt transmission line. The extreme simplicity of this method of current distribution for an electric railway will be

CATENARY TROLLEY CONSTRUCTION AT CURVE IN CITY STREET.

recognized on reading the detailed description included in this article.

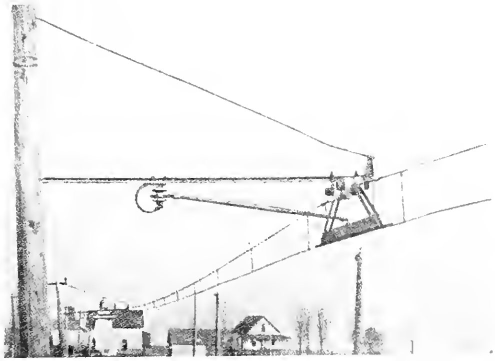
The northern terminus of the road is Windsor, Ont., across the river from Detroit. In Windsor a terminal station and office building close to the Detroit river ferry slips has been procured, so that close connection may easily be made by passengers transferring between the electric cars and the ferries to and from Detroit, which cross the river in less than 10 minute's time. Through the city of Windsor the electric road has a street franchise permitting it to operate its cars with the overhead trolley carrying current at 6,600 volts pressure. From Windsor the line takes a southeasterly direction, serving the following named towns, distant from Windsor the stated mileages: Pelton, 8; Maidstone, 12; Essex, 16; North Ridge, 20; Cottan, 21; Kingsville, 28. An extension is now under construction in Leamington, eight miles east of Kingsville. An extension from Leamington still farther east at Wheatley is proposed.

Between Windsor and Essex the electric road parallels a branch line of the Michigan Central Railroad, over



TYPICAL TROLLEY SUSPENSION BRACKET FOR LONG-RADIUS CURVE.

which, however, but a very limited passenger service is offered. From Essex to Kingsville, which is located on the north shore of Lake Erie, there is no steam railroad



SECTION-BREAK INSULATOR AS INSTALLED IN TROLLEY CIRCUIT.

competition. The route of the new line between Kingsville and Leamington parallels the north short of Lake Erie.

The roadbed is built on the public highways in the towns well ballasted with broken stone and gravel. The rail joints are electrically connected with No. 000 bonds soldered to the ball of the rail outside of towns and to the web under the fishplates in streets. Cross bonds are installed five to the mile. The bonds were supplied by the Lord Electric Company. At Essex, where the main line of the Michigan Central Railroad is intersected, a complete interlocking system is being installed.

*Adapted from the "Electric Railway Review"

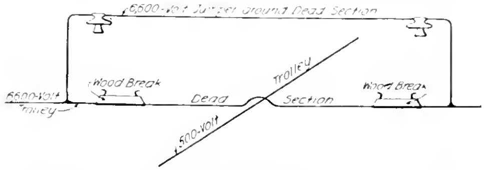
Overhead Construction.

An especially permanent type of overhead construction has been installed throughout the entire route between the power station at Kingsville and the ferry terminal in Windsor. It is interesting to note that 6,600 volts pressure is carried on the trolley in towns. The overhead construction was therefore designed and built with especial care.

The working conductor is a No. 000 grooved copper wire. It is supported by hangers spaced 10 feet apart along a 7-16 inch steel strand single cable forming the messenger. Outside of towns the messenger is hung from rod-supported angle iron brackets and within towns the catinary cable is supported by spans of 7-16 inch stranded steel cable with wood and porcelain insulators. The overhead fittings were supplied by the Westinghouse Company. Illustrations are presented showing details of the trolley supports on straight line and curve construction. The line is head guyed at intervals of 1,100 feet.

At Windsor a 500-volt trolley line of the Detroit United Railway system is intersected and an interesting piece of overhead construction was required to prevent any possibility of the electrical crossing of the two overhead conductors, one at 6,600 volts and the other at 500 volt wire it will not be able to swing far enough to make a connection with the high-pressure trolley. The dead section in the 6,600-volt trolley also requires that the single-phase cars drift across this intersection. The continuity of the 6,600-volt circuit on either side of the dead section is made complete by a jumper carried on high tension line insulators and protected by grounded guard wires.

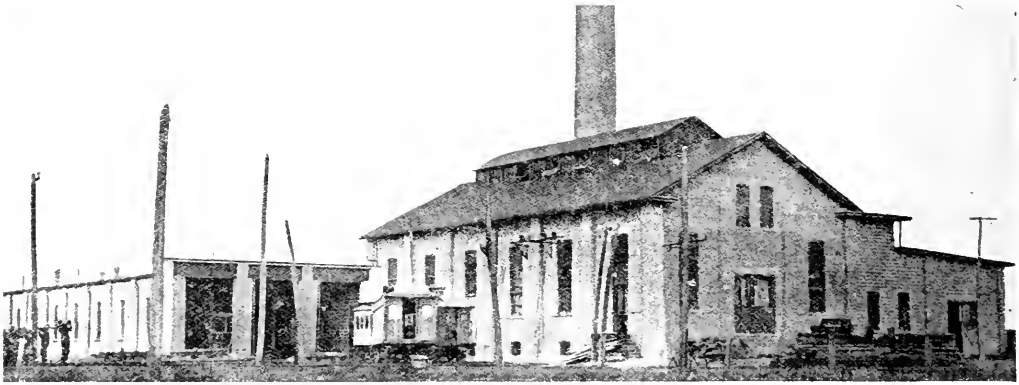
Thirty-foot wooden poles are used for all construction



Arrangements of Circuits at Intersection of 6,600 and 500 Volt Trolley Wires.

except that in the streets of Windsor these poles are set in earth and are reinforced near the surface of the ground with a 4-foot by 2 by 12-inch breast block.

Where span construction is used in the streets of Windsor the span wires are supported by concrete poles supplied by the Concrete Pole Company, St. Catharines, Ont. These poles are of two sizes, designed for 1,000 and 3,000 pounds strain. Both types of poles are rectangular in section. The smaller pole is 10 inches square at the butt and 6 inches square at the top, reinforced with four 7-8 inch round steel rods placed within the four corners. The 3,000 pound pole is 16 inches square at the butt, 10 inches square at the top and is similarly reinforced with four 1-inch round steel rods.



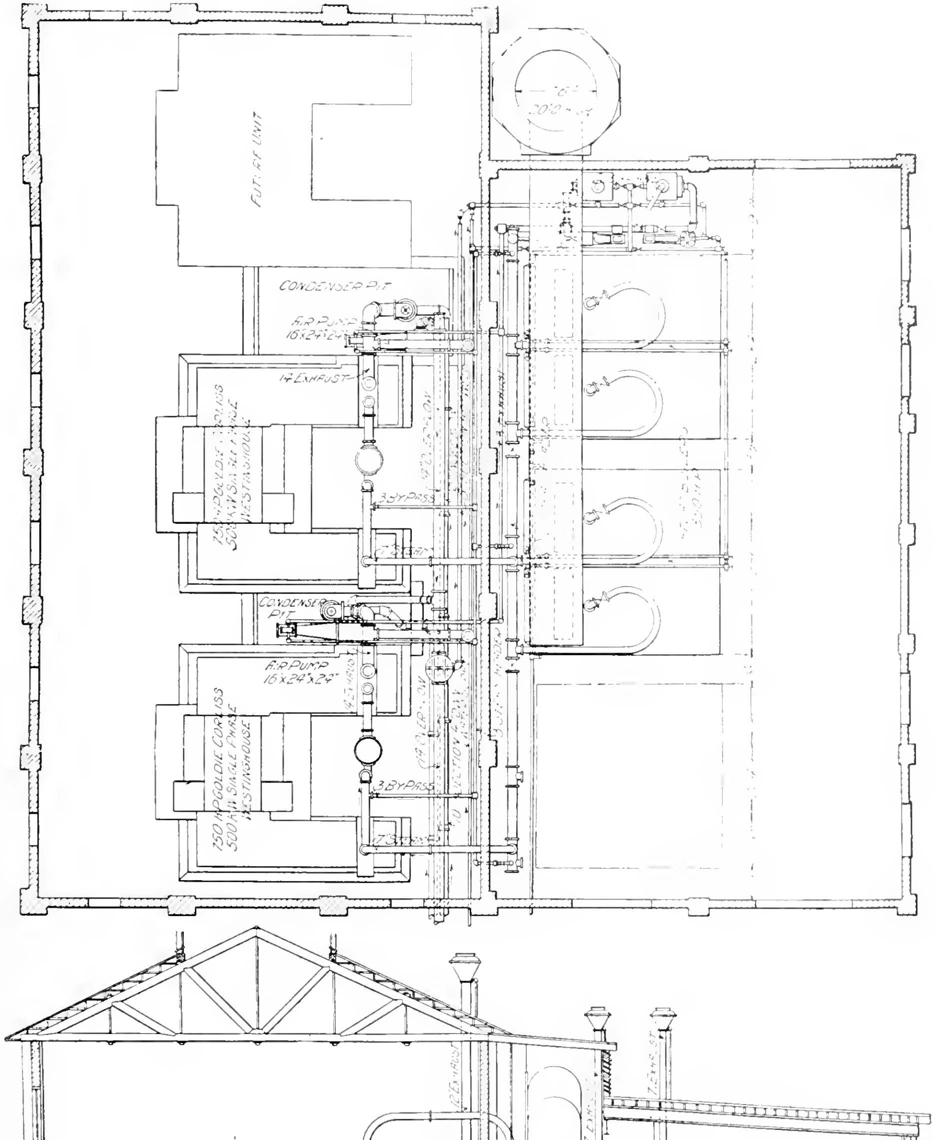
General View of Kingsville Power Station and Repair Shops.

volts. A sketch is reproduced showing the details of the wiring at this crossing. As the 500-volt line was in operation before the 6,600-volt trolley was built, it became necessary for the builders of the new line to take the necessary precautions to prevent trouble. A complete separation of the circuits was made by installing about 25 feet on either side of the 500-volt line intersected a long wood break trolley insulator placed in the 6,600 volt trolley.

This provides a dead section of catenary supported trolley for a safe distance on either side of the intersecting 500-volt trolley, which is crossed with an ordinary 90 degree trolley pan insulated for 500 volts. The length of the dead section in the 6,600-volt trolley is sufficient to assure that should a trolley pole leave the 500-

The power station building, located on a bluff overlooking Lake Erie, about a mile and a half southeast of Kingsville, is a brick and concrete structure, and comprises two general sections, a boiler house and an engine room.

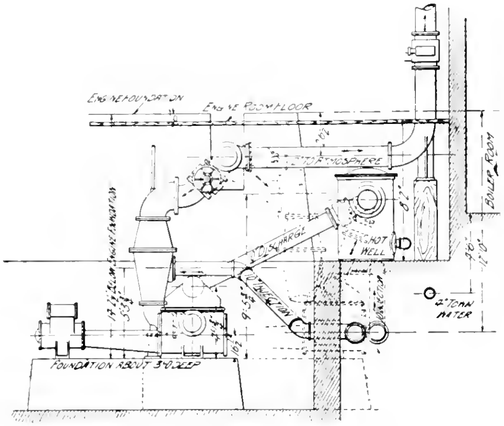
The boiler house has ground dimensions of 88 by 49 feet and the engine house 106 by 54 feet. These two sec-



Foundation Plan and Sectional Elevation of Power Station Showing General Arrangement of Piping and Boilers.

tions have one wall in common. The building has a timber truss roof covered with gravel composition over the boiler house and metallic shingles over the engine room.

Coal is brought to the boiler house over a steam railroad siding, and as yet is unloaded by hand. The boiler equipment comprises four 350 horse-power Atlas boilers, installed in batteries of two boilers each, and hand fired with coal. The building is large enough to accommodate two more boilers. The installation has been so arranged that at a later date natural gas, which soon will be available, may be used for firing. The exhaust gases from the boilers pass to a stack 7 feet 6 inches inside diameter, 5 by 9 foot flue opening and 120 feet high. This stack was built by the Alphonse Custodis Chimney Construction Company. The boilers are provided with "Cyclone" shaking and dumping grates, supplied by the Canadian Steam Boiler Equipment Company, Limited, Toronto. The boiler auxiliaries include two Cochrane feedwater heaters of 1,500 horse-power capacity.



Details of Condenser Piping in Power Station.

Steam at 125 pounds pressure is distributed through a single 12-inch header extending the length of the boiler house and parallel with the fire wall. The engine connections pass through the fire wall to the two main units.

TRANSMISSION LINE.

The method of feeding the 6,600-volt trolley is of particular interest, inasmuch as there is used an auto-transformer substation requiring only a single wire for the transmission line. The trolley wire between Windsor and the Kingsville power station is divided into two sections. An 18-mile section from the power house to Maidstone is fed direct from the 6,600-volt bus of the 3-wire generators in the power station. The section between Maidstone and Windsor, about 12 miles, is independent of the power house section and is fed by a transmission line carried at the tops of the poles along the right of way. This transmission line comprises a single No. 0

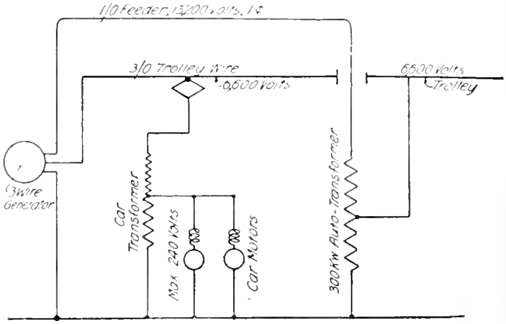
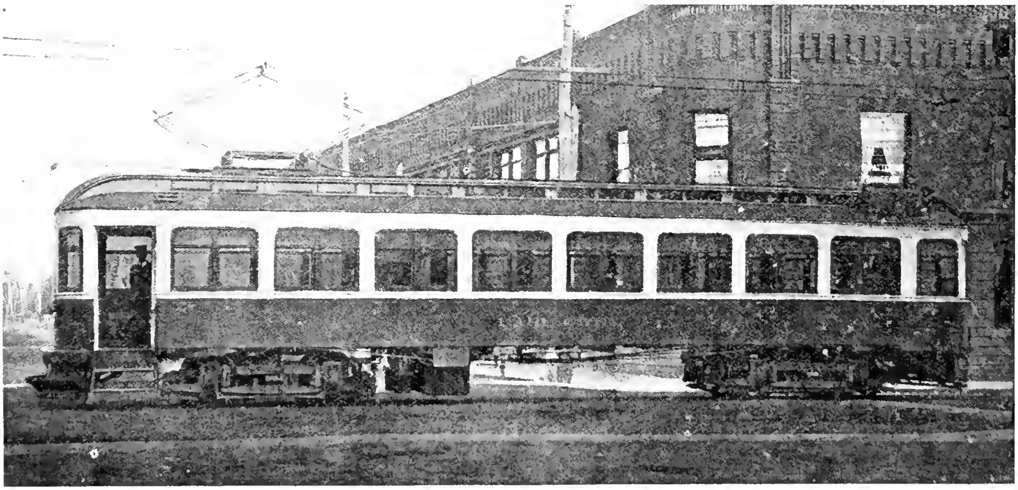


Diagram Showing Principal Transmission and Car Circuits.



Standard 3-Compartment Passenger Equipment.

wire of hard-drawn copper supported on 3-piece 40,000-volt insulators supplied by the Lima Insulator Company. The working pressure of the line is 13,200 volts. This single high-tension wire feeds a 300-kilowatt auto-transformer, which, in turn, feeds the Windsor section of the trolley wire supplying current at 6,600 volts pressure to the part of the line most distant from the power house.

An accompanying sketch shows diagrammatically how simple is the transmission and feeding system of this single-phase railway. The auto-transformer at Maidstone is installed in a concrete building 12 by 12 by 14 feet in dimensions. The circuit breaker and switch for handling the current fed through this transformer are located at the origin of the transmission line in the power station. Lighting protection and hand operated disconnecting switches complete the auto-transformer substation equipment at Maidstone.

The rolling stock equipment includes five new 3-compartment passenger cars equipped with motors and four trailers and two express cars which are being rebuilt from trailer cars formerly operated on the New York city elevated lines.

ROLLING STOCK.

The new motor cars present an attractive exterior, as illustrated herewith. These cars were built by the Ottawa Car Company, Limited. They are 55 feet long, 18 feet 6 inches wide over all, and the bodies are supported by six sills. The outside sills comprise a steel plate with wood on either side, the wood having sections 4 3-4 by 6 and 1 3-4 by 6 inches, while the steel plate is 1-2 by 6 inches in section. The intermediate sills are of wood, 3 3-4 inches by 6 inches, and the two centre sills comprise 1-2 by 6 inch iron plate between two pieces of wood 2 1-2 by 6 inches each.

The interior of the car is divided into three compartments. There is a smoking compartment at either end of the car, it being the practice to use as the smoker whichever compartment is forward. The interior of the cars are finished in oak. Each smoking compartment has four fixed double seats and eight cane-seated revolving chairs. The main compartment has four fixed double seats and eleven rattan covered double seats of the "walkover" type. The toilet compartment is placed at one end of the centre portion of the car. The cars are heated with Baker "Mighty Midget" heaters installed in the vestibules. The various fittings of the cars include continuous parcel racks, Curtain Supply Company window fixtures, American trolley catcher, Westinghouse spring operated pantagraph trolley and chime whistle.

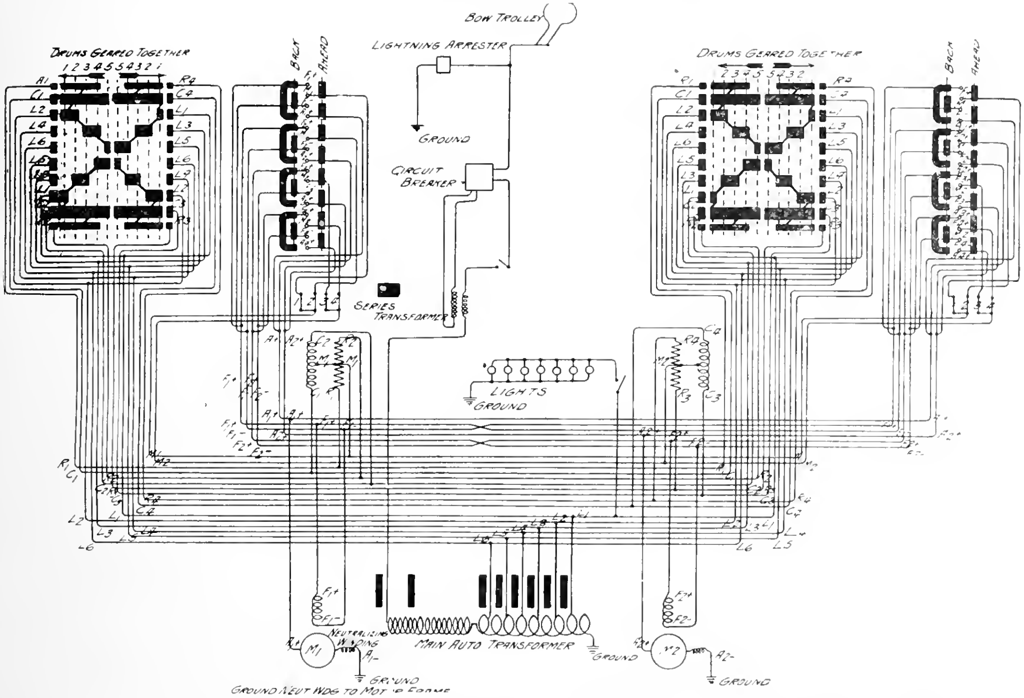
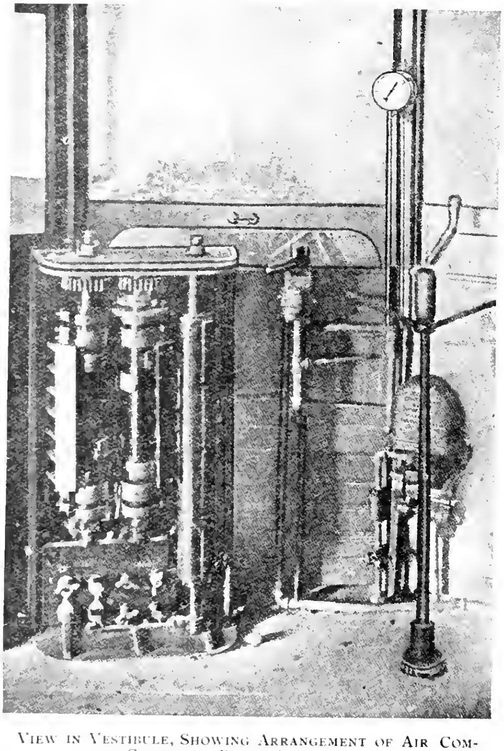


DIAGRAM OF CAR WIRING, SHOWING CONNECTIONS FOR TWO SINGLE-PHASE MOTORS AND PLATFORM DRUM CONTROLLERS.

The car bodies are mounted on two Brill trucks, with 6 foot 6 inch wheel base. The centre to centre distance between truck centres is 31 feet 4 inches. Each car is equipped with two Westinghouse No. 132 single-phase motors, rated at 100 horse-power each. The control equipment includes an auto-transformer supported from beneath the car sills by 4 by 4 by 3-8 inch angles. As

the cars are double ended two of the type 451 Westinghouse drum controllers are used to vary the voltage of the current fed through the auto-transformer to the motors. A wiring diagram is presented showing detail connections of the entire wiring on one of these cars. The simplicity of the circuits is at once noted. It should be remembered that the pantagraph trolleys on these cars collect current at 6,600 volts pressure, which current is fed to the motors at a maximum pressure of 240 volts. With the auto-transformer no resistance grids are required, the various slips in the feeding of the motors being obtained by the drum controllers, which, on being



View in Vestibule, Showing Arrangement of Air Compressor Governor, Brake Handles and Drum Controller for Two Single-Phase Motors.

revolved, vary the point in the auto-transformer coil from which the feeding current is taken.

Each car is equipped with Westinghouse S. M. E. schedule air brakes, having the quick recharge and graduated release features. The motor cars carry D-1 pumps, operated by single-phase motors. The cylinders on the motor cars are 10 inches in diameter, and those on the trailer cars are 8 inches in diameter. All cars have automatic slack adjusters. Sterling hand brakes are used.

Service and Personnel.

Inasmuch as there will be no direct steam road competition over a considerable portion of the route, it is expected that a comparatively large freight and express business can be built up. The company has a contract with the Canadian Express Company, which maintains six offices along the line, and has its own messenger on the cars during two round trips per day. All classes of freight will be accepted for transportation. Passenger service will be operated on hourly headway. The operating headquarters are at Kingsville, Ont.

The officers of the company are as follows: President, John Piggott; first vice-president, Charles Magee; second vice-president, W. E. McKeough; secretary, W. T. Piggott; treasurer, W. C. Crawford; general manager, W. N. Warburton; chief engineer of power plant, S. C. DeWitt.

THE POTENTIAL RESOURCES OF BRITISH COLUMBIA.

By Ex-Lieut.-Gov. C. H. Mackintosh.

The suggestion of an enquiry into the potential resources of British Columbia is timely, comprehensive and far-visioned; of vital interest alike to those who are toiling within and thousands beyond the seas anxious for a British territory where the surplus muscle and brawn of the Old World may be utilized.

Systematized stock-taking is an inflexible rule in commercial institutions. It applies as well to national concerns. This province need have no misgivings as to the result, for the sombre experiences and stern rebuffs of the past were not without chastening influences upon those earlier pioneers, who bequeathed the hall-mark of lusty manhood to the present generation.

The following brief epitome of potential factors contributing to the present growth and sponsors for the future advancement of British Columbia is necessary for an intelligent discussion of the subject:

Water Power for the World.

Rivers—Fraser, Thompson, Columbia, Kootenay, Peace, Stikine, Skeena, natural arteries of communication between the interior, the great lakes and the Pacific Ocean.

Lakes—Covering an area of 1,560,830 acres. In the south, Kootenay, Arrow (lower and upper), Okanagan, Shuswap, Harrison, Slocan, Trout; in the north, Quesnel; bodies of water capable of bearing upon their bosoms the mercantile marine of an empire.

Forests—An area of 182,750,000 acres, three times the forest acreage of Japan and New Zealand, and within a fraction of the acreage of Indian, Norway and Sweden, the products in active demand throughout the East, the continent of Europe, Australia, Africa, Japan, China, Peru, Mexico, New Zealand and the United Kingdom.

Mr. Thomas D. Lonergan, who for ten years was employed as electrician for the Canadian Pacific Railway and afterwards became manager for the Quebec Electric Company, is now carrying on business on his own account as an electrical contractor, with office and salesroom at 42 St. John street, Quebec, P. Q.

Electrical Trade Between Britain and Canada

That Canada has experienced, and will continue to experience, a period of phenomenal commercial and industrial growth is the opinion, not of Canadians only, but also of British capitalists. The latter have in the past had no small hand in the exploiting of this country, but so ready has the American capitalist been in pouring his wealth into the developing of our natural resources and so satisfactory the returns therefrom that a rivalry has of necessity come to exist between British and American investors, in which rivalry the former has usually not had the best of it. In a recent special issue of "The Electrical Magazine," London, a feature of which is a section devoted to trade with Canada, some comments are made on this subject.

"Experience proves," says this journal, "that where this country is in competition with the foreigners for Canadian orders, the most frequent cause of the settlement away from the British house is on the score of delivery. This is a point which cannot be emphasized too strongly. It would seem that—and particularly for the smaller classes of machinery and supplies — a Canadian stock or even a branch works is essential for the British manufacturer to maintain a continuous profitable business in the Dominion.

"From time to time we receive enquiries from readers as to the advisability of the formation of branch factories in Canada. We can here state definitely that in the great majority of cases the establishment of such branches will prove highly successful.

"It is difficult to the stay-at-home Englishman to realize the immense rate at which civilization and urban conditions are advancing in Canada; perhaps the quickest way to grasp the real progress made is to compare an up-to-date map of the country with one of ten or even five years ago. One is inclined to regret the pains of having mastered geography at school—there is so much regarding this Dominion of Canada to be unlearned.

"Returning now to the subject of Canadian branch works, we see that the great progress made is but the very small beginning in a vast territory in the further making and maintenance of which an unlimited scope for labor exists for many generations to come. In the course of correspondence with manufacturers we have noticed not infrequently the expressed disposition to postpone active work in Canada until the country is further developed and offers a more extended market. Surely this is an unreasonable attitude to adopt, and the more one considers the matter in detail the more impossible does it become to justify it.

"The towns springing up on every hand are not mere settlements or camps—they are permanent institutions for which nothing will do which is less than the very best and the latest in equipment and arrangement. The most advanced practice in civil and municipal engineering is followed. In this systematic building up of towns and cities there is brought to bear, from the beginning, a full sense of the financial or business side of municipal management. In the pursuance of this policy it is a fact that rising Canadian towns welcome the advent of factories into their midst; and, lest any misapprehension as to motive should arise, let us hasten to say that they offer substantial inducements to the manufacturer in the shape of remission of taxes, or cheap land, or even financial support to the contemplated works venture. The fact is that these manufactories are wanted by the country for the sake of their output; the importing of goods, with the consequent delay and high ruling prices, hampers the Canadian. Factories will continue to be started at an ever-increasing rate, and the municipal owners know the immense value of labor-employing concerns to any surrounding or adjacent township: hence this competition for the manufacturer's favor.

"General transport facilities by railroad, tramroad and canal already exist in a very complete form, and the active work of extending this essential proceeds without abatement. Capital is readily found for the furtherance of personal enterprise in the manufacturing field; there are partnerships entered into regularly between the experienced British manufacturing man and his moneyed colonial brother. In short, there is everything to be said in favor of the British firm establishing a Canadian works centre. Moreover, as will have been gathered, there is also great certainty in the successful outcome of individual enterprise in works ownership. This latter phase is one to which the young engineers of this country should give the closest consideration; Canada undoubtedly offers much to the well-skilled engineer, and in this trade, as in many others, it gives a full answer to the oft-asked question, 'What shall be do with our boys?'

Enter United States Capital and Brain.

"But great as is the attractiveness held out to the enterprising by the resources of Canada, it has to be confessed that outside the Dominion the chief benefit has gone not to Canada's motherland, but to the United States. Propinquity counts for much. It is so infinitely easier to cater for a market only a few hours away, often within reach even of the telephone, than for one which is on the other side of the Atlantic Ocean. United States capital has flowed freely into Canada for the development of the electrical industry, and United States capital and United States brain have been largely responsible for the difficult position in which British manufacturers and capitalists find themselves when catering for the Canadian market. One of their greatest difficulties is the Canadian adoption of United States standards and specifications.

The Market for Electrical Apparatus.

"Take electrical apparatus as an illustration of the present predominance of the United States in the Canadian electrical import trade, and one finds that the Can-

adian importations from the United States were in 1906 of the value of £487,000. This total compares with £17,000 only as the value of imports from the United Kingdom and £3,000 from Germany. Yet there is a full duty of 25 per cent. against United States imports, and British manufacturers have the benefit of a preference of 33 1-3 per cent. A similar duty and a similar preference operate in the case of electrical motors and dynamos; yet the United States importations into Canada were in 1906 of the value of £202,000. Taking United States imports into Canada over a series of years it is suggestive to note their growth.

Copper Wire.

"The trade in insulated copper wire for telephone and electrical work may be taken as another indication of United States predominance in Canadian electrical development. The imports in 1906 from all countries were of the value of about £71,000, and of this total the imports from the United States were of no less than £64,000, despite the fact that the Canadian import duty is 30 per cent., with a preference of 33 1-3 per cent. to the United Kingdom manufacturers.

"The main object of the Canadian tariff is, of course, to stimulate Canadian industry, and it is a cardinal principle of Canadian policy, no matter what party is in power at Ottawa, that Canada shall make whatever she can for herself within reasonable limits, and always remembering the interests of the general consumer. Aided by the Canadian tariff and aided also, of course, by the enormous natural advantages of Canada, the Canadian factories for the manufacture of electrical machinery and apparatus have become among the most extensive in the country. An official publication tells us that their output includes motors and dynamos of the largest capacity, as well as miscellaneous apparatus in great variety. Canada, it is officially declared, because of its numerous great waterfalls, presents an extending field for the installation of hydro-electric power-generating machinery, and the installation of power generating and transmission plants constitutes one of the main departments of electrical manufacturing. The field for electric lighting is rapidly increasing. Even the smallest hamlets are being provided with electric street lighting. Most modern houses of consequence in the cities and towns are fitted with electric light, and for the lighting of factories, public buildings, etc., its use is almost universal. On this account there is a growing demand for dynamos and all kinds of electric lighting appliances, and Canadian factories supply the entire trade. Electric equipment for street cars and inter-urban railways is made exclusively, while certain firms devote special attention to the production of electrical mining machinery.

Experience of British Manufacturers.

"But great as are the opportunities for the development of manufacturing in Canada itself, and undoubted as is the predominance of the United States in the Canadian import market, many British manufacturers speak with expectation of the Canadian market. In Great Britain itself, where they have no tariff benefit, British manufacturers have in many directions found themselves equal to the keenest United States competition, and with the aid of the preference given them in the Canadian market they see no reason why they should not develop a substantial Canadian trade. The preference has in many cases sufficed to enable British manufacturers to sell the bigger machinery in Canada as against the United States. Thanks to the preferential tariff discrimination in their favor, a large British house was recently able to secure the contract for the rolling stock for an inter-urban Canadian line, and it is realized that the Canadian demand for electrical plant is extending so rapidly that British manufacturers should, with reasonable enterprise, secure a much larger Canadian trade. With this in view many would greatly welcome a reciprocal arrangement with Canada, under which the family idea would animate the policy of the Mother Country as well as the colonies, and British manufacturers would secure in the Canadian market a greater tariff margin in their competition with the United States than is secured under the one-sided preference now in operation.

Reciprocal Preference.

"Even a cursory study of the structure of the new Canadian tariff indicates the manner in which such a reciprocal arrangement may be brought into existence. There is no responsible political party in Canada which would favor the exposure of the Canadian electrical industry to open competition from abroad; that is to say, it is useless to expect, for some years at all events, the free admission of British electrical goods into Canada. But it is the policy of all Canada parties to give British manufacturers the greatest possible advantage over the manufacturers of the United States, Germany, and other countries, and a glance at the foregoing figures illustrates how large is the amount of dutiable imports upon which a larger preference may be secured without injury to the Canadian industry. There is, moreover, that important new feature of the Canadian tariff system, the Empire Free List, and there are commodities now admitted free from all countries which in return for concessions Canadian ministers would be prepared to transfer from the General Free List to the Empire Free List, making them dutiable when coming from foreign countries, and free when coming from other parts of the British Empire."

Thus in a sentence it would seem that while there are undoubted difficulties in the Canadian market for British electricl manufacturers, there is even to-day a substantial opening for British enterprise, and Canada's certain rapid development in the near future must greatly enlarge the opportunities. It is also clear that so soon as the British people adopt the policy of Empire markets for Empire workers, and reopen the door which was "banged, bolted and barred" at the Colonial Conference of 1907, Canada will become one of our most important and profitable trade partners.

Wireless Communications Over Sea

Some idea of the ever-increasing extent to which wireless telegraphy is being used may be gathered from a paper on "Wireless Communications Over Sea," read recently by W. J. Erskine-Murray before the Institution of Engineers and Shipbuilders in Scotland. According to statistics cited by the author there are now 1,550 wireless telegraph stations in operation, and of these nearly 1,200 are giving actual service, which is an astonishing showing when one considers that the art is only about 10 years old and progress was necessarily slow at first. Dr. Erskine-Murray's paper was in part as follows:

I shall not attempt a technical description of the apparatus used in any system of wireless telegraphy, but shall confine myself to its application to nautical purposes and to general principles which define its scope and the advantages and disadvantages of the various systems at present in use. In order to indicate the magnitude of the wireless telegraph system of communications throughout the world, I have collected the following data from various government and other reports on the subject:

Total number of wireless telegraph stations 1,550, which may be classified as follows:

Commercial land stations	195
Merchant vessels	170
Lighthouses, etc. (Government stations)	150
Naval installations	670
Military portable installations	55
Experimental stations	310

These 1,550 stations have been erected by the various companies in approximately the following proportions: Telefunken, forty-one per cent.; Marconi, twenty per cent.; De Forest, six per cent.; Lodge-Muirhead, three per cent.; Fessenden, three per cent.; other systems, twenty-seven per cent. As regards commercial land stations: Marconi, thirty-two per cent.; other systems, sixty-eight per cent.

On merchant vessels: Marconi, fifty-six per cent; other systems, forty-four per cent.

The actual proportions in different regions are very various. On the North Atlantic the Marconi Company has a greater hold than elsewhere, though it is very far from having a monopoly, even in the British Islands. In South America, the West and East Indies, and on the Continent of Europe, excepting Italy, the Telefunken, Lodge-Muirhead, and De Forest companies practically do all the business. It has, therefore, been necessary for shipowners, whose vessels trade in these regions, to adopt a system other than the Marconi.

General Principles of Wireless Telegraphy — These may be summed up shortly, as follows:

1. The energy which transmits the signal is propagated over the earth's surface as an electric wave motion.

2. This wave motion, or alternate current, may be either uniform like an ordinary lighting or power current, or it may be in the form of damped wave trains, i.e., in short series of waves following one another at comparatively long intervals; each series or train commencing strongly and dying out after comparatively few waves. In the first case a high-frequency alternate current generator, or a vibrating electric arc may be used; in the latter, the intermittent spark discharge of a condenser.

3. In both cases it is necessary that the frequency of the current (number of alternations per second) should be high in order that the amount of electricity set in motion at each wave, and, therefore, the actual dimensions of the apparatus, may not be too large. This will be appreciated when it is recollected that a small quantity of electricity, or any material, when moving very rapidly, may transmit a large amount of energy. (A high-speed de Laval steam turbine is a good mechanical instance of this.) A high frequency is thus advantageous from an engineering point of view, though it is not absolutely necessary.

4. The receiving apparatus must, therefore, be capable of detecting and indicating currents whose frequencies are greater than 100,000 per second. There are now scores, possibly hundreds, of ways in which this may be done. These may be classed as follows:

(a) Imperfect electrical contacts, or coherers, whose resistance is changed by the action of the received current;

(b) Electrolytic detectors, which indicate the received currents by an alternation in polarization;

(c) Thermometric detectors which indicate the current through the effects of the change of temperature it causes;

(d) Magnetic detectors in which the magnetic state of a piece of magnetized iron is altered by the current.

(e) Electromagnetic detectors on the current balance, or electro-dynamometer principle;

(f) Valves or rectifiers, which, owing to their property of permitting current to pass more easily in one direction than the other, produce a more or less unidirectional and, therefore, measurable current directly from the alternating current received;

(g) A miscellaneous class whose methods of action have not yet been explained.

The best-known forms of coherer are (1) the Marconi, consisting of a glass tube of about five millimetres bore in which are two silver plugs about 0.5 millimetres apart, between which a small quantity of very fine nickel filings are placed. The gap is usually V-shaped to admit of regulation by merely turning the tube, as the filings only occupy about one-third of the space, and are, therefore, more or less crowded together according as the wide or narrow end of the V is uppermost. (2) The

Lodge-Muirhead, which consists of a razor-edged steel wheel about the diameter of a threepenny bit, whose edge dips into mercury covered with oil, and which is kept revolving by clockwork. The Marconi coherer, which is a modified form of Branly tube, and is also used by the Telefunken Company, requires to be decohered by tapping or shaking it after it has recorded a signal, as it would otherwise remain cohered. This, though apparently a disadvantage, is in reality the essence of its success, for it is owing to this that it was first possible to maintain the effect of the passage of the high-frequency current long enough to obtain from it a permanent record of the Morse tape by means of ordinary telegraph instruments. The Lodge-Muirhead coherer is decohered after a small fraction of a second by the movement of the wheel.

The other detectors most in use are Marconi's magnetic detector and the electrolytic received, or barretter, invented by Fessenden. Magnetic detectors are based on the fact that a high-frequency current, even if of very short duration, may produce considerable changes in the magnetism of a fine magnetized iron wire. In Marconi's form an endless band of fine iron wires is kept traveling round two pulleys. Surrounding one of the straight pieces between the pulleys is a small glass tube on which are wound two coils of fine insulated wire. One of these is connected to the aerial and earth wires, and the other to a telephone receiver. Two permanent magnets are placed so that their lines of force include part of the traveling iron band in their circuit. The motion of the band draws the lines to one side through the retentiveness of the iron for magnetism. The high-frequency current in the aerial wire, on passing through the small coil round the iron band, suddenly demagnetizes it, or rather releases the lines of force. These spring back into a position at right angles to the band, and in so doing cut the coil connected to the telephone, induce a current in it, and thus produce an audible click in the instrument. The motion of the band soon draws the lines aside again and renders the apparatus ready to indicate a new signal. The Morse "dash" is, of course, represented, as in all systems of wireless telegraphy, by a close succession of dots.

The electrolytic receiver, or barretter, depends on the fact that if a constant voltage be applied between electrodes dipping into an electrolyte, one of which is of very small area, the current is, under certain conditions, unstable, and the sudden super-position of a high-frequency current causes a sudden and considerable increase in the direct current. The action is not yet properly understood, though many theories have been stated. A telephone is generally used in connection with this detector, which is one of the most sensitive of all.

It is noticeable that in the above list of detectors of high-frequency currents there are very few, if any, which give directly an audible or visible indication of the signal. In practically every case it is thus necessary to have some auxiliary instrument to indicate to the operator that the detector has reacted. In some cases a telephone, syphon recorder, or Morse inker, may be used at will, in others the telephone is the only auxiliary suitable, and it is, therefore, not possible to obtain a permanent record of a message.

5. The waves are propagated outward from the transmitting station, either equally in all directions, or with a maximum in one direction according as the aerial wire is vertical or inclined. In the latter case the strongest transmission is in the direction of the lower end of the wire. This method is used at Clifden and Glace Bay, Marconi's transatlantic stations, and at Knockroe, the Poulsen transatlantic station now building.

The lines of electric force are in general attached to the ground and follow it, as they do a wire in ordinary linear conduction. The resistance and dielectric constant of the ground are important factors in determining the distance to which it is possible to signal with any given transmitter and receiver. In general, the dielectric constant is the more important of the two, and the chief reason why it is more easy to transmit signals over water than land is that the dielectric constant of water is eighty, while for dry sand or rock it is only about five. Thus it is possible to transmit signals very much further over water with a given power than over land. The actual ratio of the distances is now calculable approximately in cases where the natures of the soil and subsoil are known.

6. It is now easy to determine with considerable accuracy, in fact within a few degrees, the direction from which a message is coming—a discovery which may in the near future become a great aid to navigation, since any two land stations within range of a ship will be able, by making simultaneous observations, to give their bearings, and thus to fix the actual position of the vessel. In these days of ever-increasing speeds it is becoming more and more essential that the shipmaster should be warned, when still a considerable distance away, of his approach to land. This has been done for some years by wireless telegraphy, but it is only recently that it has become possible to add to the warning a statement of the actual position of the ship at the time of sending.

7. The speed of transmission at moderate distances, and the reliability of a wireless connection, are now both as good as the same qualities in an ordinary land wire. A proof is given by the abolition of the post-office wire from Hunstanton to Skegness, England, since wireless stations have been erected, and the fact that a speed of ninety words per minute has been attained between these stations.

8. The means of preventing interference between neighboring stations have been developed to such good effect in the last few years that it is now possible, as experience shows, to construct apparatus which will respond only to waves which do not differ by more than about four per cent. from the proper wave length for the station. An even greater sharpness in tuning has indeed been claimed by various workers, and may very

(Continued on page 26.)

Steam Motor Cars on the Intercolonial Railway

On the Intercolonial Railway experiments are being conducted with steam motor cars, two different type of these being already in service. In both a steam truck forms the motive power development. One of these is on the Ganz system, developed in Europe, in which a high pressure steam generator is used, gearing being interposed between the engine shaft and the driving axle as in the Wagenhals car.

GANZ STEAM CAR.

The car on the Ganz system is interesting on account of its special mechanical features and also from the fact

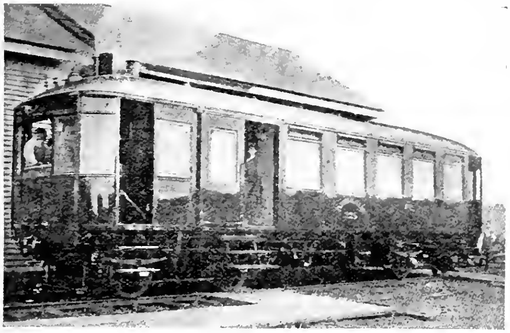


FIG. 1—STEAM MOTOR CAR ON THE GANZ SYSTEM FOR THE INTERCOLONIAL

of its being of a type which has been used quite extensively in Europe and is now being manufactured in this country. About 200 of these cars are now in use in Europe, and two cars for the Florida East Coast Railway and the Intercolonial Railway were imported from the works of Ganz & Company, Budapest, Hungary.

The car for the Intercolonial Railway is shown in Fig. 1 and is thus described by the "Engineering News," to which publication we are also indebted for the illustrations:

At the front end is a boiler room 7 feet long, which contains the steam generator, the operating levers, feed-water pumps, lubricators and small accessory apparatus. Next to this is a 7 foot baggage room, then a smoking room for 8 persons, and the main compartment with seats for 32 passengers. At the rear end is a vestibuled platform. The car weighs 28 tons in working order and carries a supply of fuel and water sufficient for a run of 50 miles. It is fitted with air and hand brakes, steam heat, and an acetylene gas lighting system. The frame and outside sheathing are of steel.

The boiler is of a high-pressure type, and consists of four vertical cylindrical shells forming two annular water chambers which are connected by a series of tubes; these are slightly inclined from the horizontal, and provide the greater part of the heating surface. The upper tubes, being in the steam space, serve to dry the steam and can superheat it by about 150 degrees F. The volume of water is small, and a continuous feed is supplied by pumps, being automatically varied to correspond with the steam consumption. The working pressure is 260 to 300 pounds. The fuel (anthracite or bituminous coal) is fed from the top into the interior cylinder, and falls upon a grate beneath the boiler; the gases and products of combustion pass through the annular space between the two water spaces. The boiler is 3 1-2 feet diameter and 4 feet high, and can develop 120 horse-power. The motor, Fig. 2, is a two-cylinder compound horizontal engine, with piston valves, and is suspended from the steel sills of the car. It drives the rear axle of the four-wheel truck through a single set of gearing with a ratio of 1 to 2.67. The tractive effort is about 4,000 pounds. The engine runs normally at about 800 revolutions per minute, but can be run at 1,100 revolutions per minute. All parts are enclosed, and the crank shaft, valve gears and driving gears run in an oil bath. The cylinders are lubricated by force-feed lubricators operated by an eccentric on the driving axle of the truck.

It is stated that before this car was accepted a number of trials were made by the Intercolonial Railway. The official test was from Moncton to Harcourt and return, a distance of 75 miles. The run from Moncton to Harcourt, 37 1-2 miles, was made in 62 minutes, or at the rate of 37 miles per hour. The maximum speed was 43 miles per hour. The total coal burned in the 75 miles was 925 pounds, which is equivalent to 12.3 pounds per

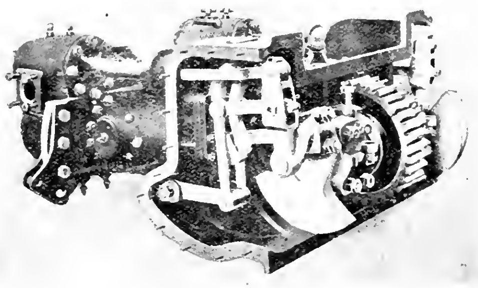


FIG. 2—ENGINE OF GANZ MOTOR CAR WITH CASING REMOVED.

mile. The guarantee was for 16 1-2 pounds per mile. On a 1 per cent. grade one mile long from Moncton to Berry Mills, a speed of 30 miles an hour was obtained. In another test over a distance of 26 miles, the steam car hauled a trail car weighing 24 tons and the average speed was 31 miles per hours.

DIRECT CONNECTED STEAM CARS.

On these cars on the Intercolonial the front end is carried by a four-wheeled steam truck on which the boiler is mounted, independent of the car body; outside cylinders drive the rear axle, while the wheels are connected by coupling rods. The cars also have vertical boilers resembling those used on the steam cars of the Great Western Railway (of England). The engine can develop about 200 horse-power and is designed to give a speed of 25

miles per hour on a grade of 1 per cent. It can also have a trail car when necessary. The car is of wooden construction and of ordinary design, except that an elliptical instead of monitor roof is used over the engine room. This part of the roof is of iron, and is removable, so that the boiler may be lifted out.

The engine room is 13 1-2 feet long, and behind this is a baggage room 8 1-2 feet long; next to this is a smoking compartment 9 feet long with seats for 12 persons, while the main compartment (30 feet 3 inches long) seats 40 persons. At the rear end are two toilet rooms. The vestibuled platform is extended to accommodate the apparatus necessary for operating the car when running with this end in front; this includes a lever connected to the throttle valve, a brake valve, and cords for the bell and whistle. This end of the car is carried by an ordinary four-wheeled passenger car truck. The cars are heated by steam and lighted by the vapor system of the Safety Car Heating & Lighting Company, using mantle lamps. The front end of the car has a cast steel body bolster of diamond shape, which surrounds the boiler, and is connected to a transverse bolster beneath the ash pan. This latter has a centre plate engaging with a similar plate on a cast steel truck bolster suspended from the truck frames by four hangers. These hangers have equalizing springs with caps seated in hemispherical sockets so as to allow for the motion of the car body in passing around curves. Vibration is checked by horizontal springs between the boiler and the bolster.

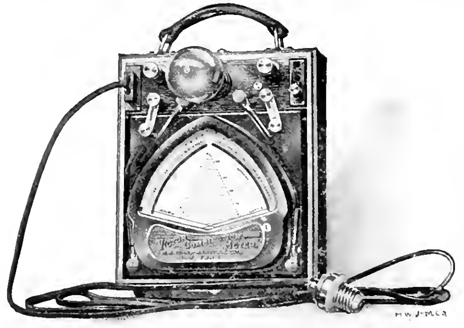
The steam truck has bar frames, connected by a cast steel cross brace in front of the cylinders. The cylinders are outside and drive the rear wheels, as already noted. Coupling rods are used, and the slide valves are operated by Walschaert valve gears. Semi-elliptic springs are placed over the boxes, but are not equalized. The vertical boiler is 4 feet 8 inches diameter in the barrel and 6 feet in the upper part, which forms a steam drum. There are 360 copper tubes 1 1-2 inches diameter, and as these extend 6 inches above the water line (to the smokebox) they serve to dry or superheat the steam. The steam is taken from the top of the steam drum by a pipe leading to a T-head at the side. This carries the throttle valve and connections to the two steam pipes. The exhaust pipes parallel the steam pipes and connect with a T-head from which a pipe is led to the exhaust at the smokestack. Feed-water is supplied by injectors. The boiler rests on a cast steel transverse frame, which is seated on the truck frames and bolted to both the boiler and the frames. Two coal bunkers in the front corners of the boiler room carry together about a ton of coal; and 1,200 U. S. gallons of water are carried in tanks hung beneath the car. Three of these steam cars have been built at the railway shops at Moncton, N.B., to the designs of Mr. G. R. Joughins, superintendent of motive power. The general dimensions are as follows:

Length over end sills, 66 feet; driving wheels, 3 feet 6 inches; truck wheels (trailing), 3 feet; wheel base, steam truck, 8 feet; distance c. to c. of trucks, 49 feet; journals, driving axles, 7 x 16 inches; boiler, diameter, 4 feet 8 inches; boiler pressure, 180 pounds; firebox, diameter, 3 feet 10 inches; firebox, height, 3 feet 5 inches; tubes, No. 360, outside diameter, 1 1-2 inches; tubes, height, 4 feet 10 inches; heating surface, tubes 685 square feet, firebox 44 square feet, total 729 square feet; grate area, 11 1-2 square feet; cylinders, 12 x 16 inches; Height, rail to top of smokestack, 15 feet 3 3-8 inches; weight of steam truck (with boiler), 51,000 pounds; weight of car in working order, 142,500 pounds; coal, 2,240 pounds; water, 1,200 gallons.

NEW TYPE OF DIRECT CURRENT METER.

A new type of direct current meter which is said to offer many advantages to the inspector, lamp salesman, lamp manufacturer, etc., has just been placed on the market by the H. W. Johns-Manville Company, 100 William street, New York.

The movements are built on the familiar d'Arsonval pattern, and are so placed with reference to each other and the scale, as to render the energy consumption directly readable at the intersection of the volt and ampere indicator needles. The special feature of the meter is the design which enables the operator to read at one glance the pressure, current and wattage on any lamp which may be inserted in a socket immediately above the meter. The instrument is equipped with three self-



Direct Current Meter.

contained shunts, one of 150 amperes capacity, having conveniently arranged binding posts, and a 1.5 and .75 ampere shunt, which is so connected within the base of the meter as to be readily thrown in circuit at will.

In order to test a lamp it is only necessary to connect the attachment plug and cord to any lamp circuit, insert the lamp and read volts, amperes and watts without computation. The different shunts may be easily placed in circuit by the adjustment of a small screw-plug at the top and right of the instrument. The two smaller shunts have universal connections. The volt meter may have either 150 or 300 volt scale or both.

The most valuable feature of this instrument is the fact that accurate wattage measurement may be taken on a fluctuating load, as it is required to observe but a single point for such readings. It is entirely self-contained and weighs less than fifteen pounds complete.

C. S. C. E. HOLD ANNUAL MEETING.

From January 28 to 30 last there was held in Montreal the twenty-second annual meeting of the Canadian Society of Civil Engineers. Over 400 members and delegates were present. The convention opened with an address by Mr. McLea Walbank, in which some strong criticism of municipal ownership was included, conditions prevailing in Glasgow being instanced as a timely example of the undesirability of that practice being pursued in this country.

"Wages in Glasgow," said Mr. McLea Walbany, "are less than half those paid in this country. Conductors on street cars in Glasgow are paid 93 cents per day for the first year, and $1.04 the third year, while conductors on street cars in New York are paid $2 the first year, and $2.25 after that. The average wages for the railroad men in Glasgow are 78 cents per day, while in New York they are $1.88. Here we have a difference of more than 100 per cent. in wages alone.

DEAN GALBRAITH, SCHOOL OF SCIENCE, TORONTO, PRESIDENT, C.S.C.E.

"Anyone who has traveled over the street railroads in Glasgow must know perfectly well that the whole equipment and accommodations are antiquated and behind the day, while the service furnished there would not be tolerated in any city in the United States. We are also told that the profits or revenue from the street railway in Glasgow is so large that it pays all the expenses of the Government, while in fact the roads are not operated for the purpose of producing a revenue to meet current exepnses of the municipality. Instead of there being no taxes in Glasgow they are more burdensome in this country.

"Rents are taxed 12 1-2 cents on every dollar that a man pays, and the owner of the property has to pay the same amount of tax. Besides this, license taxes are levied. You pay a tax for every servant you employ in the house, also on every horse and carriage; in fact, you cannot turn round without running against the tax collector.

"The Institute of English Bankers a short time ago attributed the widespread depression that existed in Egland at the time to the engagement in municipal trading. They pointed out that it has been productive of many evils, such as the elimination of personal initiative and enterprise, evasion of the natural laws of commerce, and the creation of a favored class of labor. It had brought corruption in politics, and practically eliminated in many directions any further attempts to engage in private industry."

The question of capital and labor, with reference to the recent financial panic, was then discussed. Mr. Walbank recognized that in some points the corporations were to blame, but he deprecated the wholesale condemnation of these institutions. Was it to be forgotten, he asked, that from these sources the people at large had derived hospitals, colleges, museums, special chairs of learning, and other boons too numerous to mention?

"I think that a close examination," said Mr. Walbank, "of most gas, electric and public utility companies will reveal the fact that the public and taxpayers in general derive more benefit than do the ordinary shareholders, whose money has made them possible."

On the evening of the 29th the annual banquet of the Association was held at the Windsor Hotel, with 150 members and guests present. The election of officers on Thursday resulted in the election of Dean Galbraith of the School of Practical Science, Toronto, as president. The other officers are: First vice-president, W. F. Tye, Montreal; second vice-president, H. M. McLeod, Winnipeg; third vice-president, G. H. Duggan, Sydney, N. S. Council—F. S. Busteed, Vancouver; N. J. Ker, Ottawa; R. W. Leonard, St. Catharines; A. H. Mitchell, Toronto; J. E. Schwitzer, Winnipeg; Roderick McColl, Halifax; A. A. Dion, Ottawa; A. E. Doucette, Quebec; W. R. Butler, Kingston; F. P. Gutelius, Montreal; H. H. Holgate, Montreal; R. S. Kelsch, Montreal; R. J. Durley, Montreal; C. M. Odell, Glace Bay, N.S.; W. H. Briethaup, Berlin, Ont.; J. B. Porter, Montreal; J. G. Kerry, Toronto; F. W. Robb, Amherst, N.S.; T. H. Wicksteed, Montreal; Wm. Kennedy, jr., Montreal. Nominating Committee, Messrs. Rust, Ker and Dill, Toronto; Messrs. Lordly and Monserrat, Montreal, and W. Dodard, N.S.

A COSTLY PLANT.

A Vancouver, B.C., despatch states that at an expense of ten million dollars the Pacific Coast Power Company Corporation, which was recently organized by the Stone and Webster interests, of Boston, will erect in Pierce county, Washington, at the foot of Lake Tapps, the second largest electric power plant in the United States, having a capacity of 100,000 horse-power at first, and subsequent development will follow as fast as additional power is required for the network of interurban electric railways and for the Standard Gage interurban system, which will unite the cities of Vancouver, Bellingham, Everett, Seattle, Tacoma, Olympia, Aberdeen and Portland.

NOTES OF INTEREST.

The Hutton Electric Company have just installed at the Arlington mines, near Slocan city, B.C., a complete electric lighting plant, including a 25 kw. 500 volt water driven dynamo.

John Buckworth, an electrician employed by the Winnipeg Electric Railway, was severely burned last month by coming into direct contact with a wire upon which he was working.

The British Columbia Electric Railway Company will enter upon the electrification of their New Westminster and Eburne line next month, and it is expected that the system will be in operation by September.

The Vancouver Furniture Company have recently opened up their new factory on Alexander street. This factory is modern and up-to-date in every respect, and electric drive is used. Allis-Chalmers-Bullock Company's motors were installed.

While at work on a motor in the Canadian Westinghouse Company's plant at Hamilton an employe named Little fell across some highly charged wires and came near meeting his death, being saved by the prompt action of a Miss Doxter, who dragged the man into safety.

There is now being formed in Winnipeg a power league, the object of which is to keep before the public the question of cheap power in the city and to urge upon the council the desirability of going ahead at the earliest possible moment with the Point du Bois development.

MacGowan & Company, of Vancouver, B.C., who are operating large coal properties on Vancouver Island, have recently installed an 8 1-4 inch by 10 inch double cylinder reversible link motion Lidgerwood hoisting engine, purchased from the Allis-Chalmers-Bullock Company, Limited, Vancouver, B.C.

The Canadian Society of Civil Engineers, at their annual meeting, held a short time ago in Montreal, voted the sum of five hundred dollars towards the scheme of securing the Plains of Abraham and the battlefield of St. Foye as a natural park in connection with the Quebec tercentenary celebration.

The Marine Iron Works, of Victoria, B.C., are enlarging their boiler shops in that city and have recently placed an order with the Vancouve rofiice of the Allis-Chalmers-Bullock Company, Limited, for two 20 horse-power 1,120 revolutions per minute induction motors and a 10 inch by 10 inch class "E" air compressor.

The Department of Public Works, New Westminster, B.C., have recently placed an order with the Vancouver office of the Allis-Chalmers-Bullock Company, Limited, for a type "H-9" 5 1-2 inch Ingersoll-Sergeant submarine rock drill, complete with the necessary equipment, for operation in the harbor at Victoria, B.C.

At the annual meeting of the Sherbrooke Power, Light & Heat Company, of Sherbrooke, Que., held last month, it was decided to sell the company's plant and business to the city. The company undertake to sell at any time before July 2 at a price to yield the shareholders $85 a share, the city to assume the company's bonds.

In order to meet the ever-increasing demands in their business the Hamilton Powder Company, of Nanaimo, B.C., have recently ordered through the Allis-Chalmers-Bullock Company of Vancouver, a 20 horse-power and 30 horse-power 850 revolutions per minute 220 volt induction motor to be used in their power works.

The city of Vancouver have recently installed a number of Allis-Chalmers-Bullock Company's motors for the operation of blowers in connection with the heating and ventilating systems in their school houses. This order was placed after careful investigation and included five 7 1-2 horse-power and four 10 horse-power three phase 60 cycle induction motors.

The Minnedosa Power & Development Company, of Minnedosa, Man., have obtained permission from the Department of the Interior to raise the waters of the lakes in the Riding mountain timber reserve in order to regulate the flow of water in the river. An agreement has been entered into by the company to take over next summer the electric lighting plant now in operation at Minnedosa.

The Wellington Colliery Company, of Victoria, B.C., have decided to install electric hoisting and unloading apparatus on their coal wharves at Ladysmith and have placed an order with the Vancouver office of the Allis-Chalmers-Bullock Company, Limited, for a generating unit and electric hoists, including a 60 horse-power Doble impulse wheel with needle, nozzle and governor, direct connected to a 240 volt d. c. generator; also several 25 horse-power variable speed d. c. motors for hoisting service.

Kelly Brothers & Mitchell, who are operating large stone working yards in Vancouver, B.C., have recently purchased from the Allis-Chalmers-Bullock Company, at Vancouver, a large sized belt driven Ingersoll-Sergeant air compressor with unloader and receiver. This will considerably increase the capacity of their plant, which, up to the present, has been operated from a 16 1-4 inch by 18 inch belt driven Ingersoll-Sergeant air compressor. Both compressors are driven by Allis-Chalmers-Bullock induction motors.

The British Columbia Electric Railway Company, of Victoria, B.C., are installing a complete water system for fire protection, using standard hydrants and nozzles, on their properties in that city, and have purchased from the Allis-Chalmers-Bullock Company at Vancouver an 8 inch two-stage Worthington turbine pump direct connected to a 150 horse-power 2,200 volt, 3 phase, 60 cycle Allis-Chalmers-Bullock induction motor, also an electric driven dry vacuum pump. This outfit will readily handle 1,000 imperial gallons per minute and salt water will be used throughout the system.

It is difficult to realize how so many people come to overlook the importance of entrusting electrical work only to those who have a thoroughly competent knowledge of their business. At Winnipeg the results of this carelessness have been particularly distressing, according to a report recently issued by the City Electrician, who calls attention to the need of an examining board for the due licensing of master electricians. During the past twelve months two fatal accidents occurred in Winnipeg through the tampering of inexperienced persons, and several fires were indirectly caused by the same trouble.

It is reported that the C. P. R. are considering the electrification of part of their system in British Columbia. For some years they have been in negotiation with the West Kootenay Power & Light Company, who own a plant at Bonnington on the Kootenay river, twelve miles west of Nelson. The power would extend over an area having a radius of one hundred and fifty miles from these falls. Twenty thousand horse-power is the present capacity of the plant, but within the next few years it is probable that this figure will be nearly doubled. It is estimated that the cost of haulage from the mines would be just about halved by the use of electricity.

An official visit was recently paid by Mayor Taylor, of Nelson, B.C., in company with the entire civic engineering staff, to the municipal power plant on the Kootenay river, eleven miles below Nelson, which that city are about to take over. The plant is capable of generating 1,500 horse-power and supplies Nelson with power for its municipally owned lighting system and tramway, besides giving power to the various industries of the place. On the opposite bank of the river T. May, the installing engineer for the Westinghouse Company, has just finished his work on the big plant of the West Kootenay Power Company, supplying Rossland and the Boundary with power for their mines. The latest addition to this plant is capable of generating 16,000 horse-power, and has been erected at a cost of over one million dollars.

An action of great importance to the Burrard Power Company, of Vancouver, B.C., is now pending, a suit having been brought against them by the Attorney-General, who contests the validity of the company's large water record for 250,000 acres out of the Lillooet river, lake and tributaries on the ground that the rights of the federal government in the railway belt have been infringed upon by the water records based on the provincial Water Claims Act. Admiralty Judge Martin will decide the case.

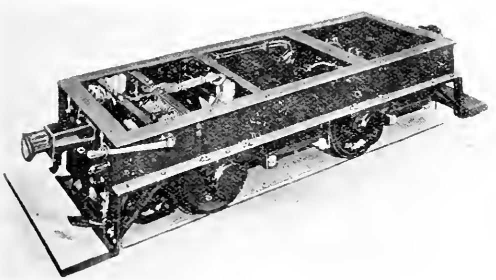
STORAGE BATTERY AUTO-TRUCKS.

Beset by the problem common to all large industrial establishments of transporting material from one part of the works to another in an economical manner, the Westinghouse Machine Company found the most satisfactory solution in storage battery autor-trucks of its own design and construction.

Convinced by the results obtained during several years of continuous service, of their fitness for the purpose, the company has put the trucks on the market and is now prepared to furnish them in capacities of from ten to forty tons.

The system in use in the works of the Westinghouse Machine Company previous to their introduction consisted of small cast iron trucks of three-foot gauge, moved by hand, whose load was necessarily restricted to a few tons. Heavy castings were transported to a position where they could be handled by the overhead cranes by means of fifty-ton trucks, which were usually moved by a rope passing under a snatch block and attached to a crane hook.

When the storage battery auto-trucks were installed, a surprising change took place. On account of the facility with which the trucks could be handled, delays of material in transit were practically done away with, and since the trucks furnished their own power, the number of laborers required for the moving of material was greatly reduced. More important still, there was a marked improvement in crane service, since a crane was no longer needed for transporting castings below ten tons in weight (the first trucks installed being of ten tons capacity) from one end of the long shops to the other, driving several cranes before it and putting them temporarily out of commission. When larger trucks were added there was a corresponding improvement in crane service.



10-Ton Truck, Deck Removed.

The trucks, though of extremely simple construction, are very substantially made of the best materials. A steel frame, thoroughly braced, is carried on four wheels, the journals of which run in roller bearings. The driving axle or axles, as the case may be, carry the motor, or motors, as in street railway practice. The motor is spring suspended from the frame at one end, and connected to driving axle by suitable reduction gearing. A spring suspended cradle of angle iron carries the battery trays. At the operating end of the truck are mounted the controller, brake, charging receptacle, cut-out switch and volt-ammeter. A convenient step and draw bar head are provided at each end. All the machinery is below the top of the frame and is covered by a heavy wooden deck for carrying the load. This deck is made in sections, so that any part of the mechanism is readily accessible.

The motor is of the well-known Westinghouse vehicle type, capable of standing heavy overloads, is dustproof and self-oiling. The controller is also of the Westinghouse vehicle type, giving four speeds in either direction. It is provided with operating and reverse levers, which are interlocking to prevent premature reversal, thus protecting the motor and the batteries.

The battery is contained in two or more trays of cells, and is of ample capacity for the particular service. It is especially designed to operate at high rates of charge and discharge, and, therefore, a battery of four or five times the capacity, as is usually the practice in similar service, is not needed, since the plates in this battery are capable of discharging at a very high rate for three or four minutes at a time without injury. Another reason for adopting a battery of smaller ampere hour capacity than is customary in similar work is that the time available for charging during the working hours is usually thrice the period of time that the truck is actually running. Charging is made so simple that the truck can easily be charged during these idle periods.

During a six months' test of the standard ten-ton truck herewith illustrated, the power required to charge the battery in regular and heavy shop service was accurately metered. It averaged 63 kw. hours per month. At the high figure of 5 cents per kw. hour, the cost for the current would be only $3.15. The work done was recorded and averaged practically 700 ton miles per month, the loads running from a few hundred pounds to fifteen tons.

These trucks used as locomotives on a level track and without any weight to secure adhesion can haul, on suitable cars, from one-half to their full capacity as a truck, depending upon the condition of the track and kind of bearings on the cars hauled. By placing sufficient weight over the drivers to secure adhesion, they are capable of handling from one to two times their capacity as a truck for a continuous period of not more than five minutes.

Standard trucks are made for six different gauges, namely, 18, 21 1-2, 24, 30 and 36 inches, and 4 feet 8 1-2 inches. For track systems provided with turn tables, they are made with rigid trucks. Where tracks are installed with curves, the trucks for all gauges up to 36 inches are provided with swivelled front axle, permitting free operation on curves as low as 12 feet in radius.

WIRELESS COMMUNICATIONS OVER SEA.

(Continued from page 20.)

probably have been obtained. A margin of four per cent. is, however, sufficient to render possible the efficient working of a very large number of stations in a comparatively small area without interference. The actual wave lengths to be used by ships and shore stations have been fixed in some countries; and in all which are parties to the International Convention, the wave lengths from 1,600 metres are reserved for naval purposes; wave lengths below 600 metres being available for short distance stations, and those above 1,600 metres for long-range stations. The usual wave length for short distance stations (i.e., under 100 miles range) is about 400 metres. The German long distance station at Nauen uses wave lengths of 2,000 metres; Poldhu (Marconi) of about 2,500 metres, and Clifden of about 4,300 metres.

Wireless Telephony—As, in the bridging of the Atlantic, wireless telegraphy takes its place this year as a factor in the long distance communication of the world, one is suddenly made aware that a new agent has emerged from the darkness of the "experimental stage," and has arrived for good. The United States navy has ordered twenty-eight sets of wireless telephones for use in communicating between warships. To those who have followed the experimental work which has been going on during the last eight years this development is not a matter of surprise, but merely a logical consequence, and now that the apparatus has reached so reliable a state that it is deemed suitable for use in warfare, it is practically certain that wireless telephony will make such rapid strides that, within the next five years, the development will be as great as that of wireless telegraphy in the past decade, and that in fact we shall have come in 1912 within measurable distance of opening up direct telephonic communication with every important city on the surface of the globe.

A vessel fitted with a wireless apparatus is practically never out of range of a commercial wireless telegraph station as long as it is within sixty or seventy miles of any part of the coast of the British Islands. The same is true of Europe, of the eastern coast of North America, from Labrador to Florida, and for the whole Gulf of Mexico and the West Indies. There are six or seven stations at various points along the east coast of South America, and ten or a dozen stations at points on the Pacific coast of South and North America. On the route to India and the East, there are points of communication after leaving the Channel which simply bristles with stations, at Ushant, Corunna, all round the Mediterranean, including even Tripoli, Tunis, and Algeria, Port Said, Port Tewfik, Sauger Island, India; Diamond Island, Burma; the Andaman Islands, the Philippines, Tsingtau, China; the Japanese coast, the Sandwich Islands, and Samoa. In addition to these stations, which are open for commercial work, there are, of course, many more which are intended for naval and lighthouse communications only, but which would be available in case of emergency to any vessel in distress.

WIRELESS TELEGRAPHY ON THE GREAT LAKES.

The extent to which wireless telegraphy is being used on the great lakes will be appreciated, says the "Electrical World," when it is known that nearly 70,000 messages were handled during the season of 1907 for marine interests by the Clark Wireless Telegraph System.

When the season opened, early in March, there were only two stations in operation, one at Detroit, Mich., and the other at Cleveland, Ohio. Early in the month of May a station was placed in operation at Port Huron, Mich. In August a fourth station was placed in operation, at Buffalo, N.Y., and in September a fifth station was placed in operation, at Toledo, Ohio. The five stations brought Buffalo, N.Y., Cleveland, Ohio, Toledo, Ohio, Detroit, Mich., and Port Huron, Mich., into wireless communication.

With the opening of navigation, the Clark Wireless Telegraph Company began the work of soliciting the telegraph business of the bulk-freight handlers from many of the large marine interests on the great lakes. These interests combined represent some 320 fleets and over 1,000 vessels. The telegraph work consisted in reporting boat passages, orders, etc., from Port Huron and Detroit to the owners' and managers' offices in Cleveland, Toledo and Buffalo, and in receiving reply messages and orders for the captains of the boats, as to the destination for the vessel to go with her cargo, also furnishing the Cleveland office with all the up and down passages at Port Huron station—these were transmitted twice daily. The passages up to 8 o'clock in the morning were sent in at 8.30 a.m., and the passages up to 1.30 in the afternoon were sent in at 2.30 p.m. The vessel owners were thus able to formulate the destination orders before the vessels reached Detroit.

In many instances the vessel orders and destination orders were given for the vessel on passing at Detroit, and the destination changed again before the vessel passed the Lime Kiln Crossing. In many instances this could not have been accomplished by wire telegraph or even long distance telephone. The Cleveland station operator and Detroit station operator transmitted and delivered some of these rush message orders in less than three minutes. It is stated that the stations were operated for the entire season without serious delays.

NEW ELECTRICAL INSPECTOR.

The Canadian Fire Underwriters' Association have appointed Mr. James Arthur Hall as assistant electrical inspector in this city. This completes a staff of four men, including the chief of the department, Mr. H. F. Strickland. Mr. Hall has severed his connection with Philip Lahee, the well-known electrical engineer and contractor, and commences his duties at once.

PUBLICATIONS.

"The Electric Furnace—Its Evolution, Theory and Practice," is treated in a neatly bound manual published by "The Canadian Engineer," Toronto. The author is Alfred Stansfield, D.Sc., Associate of the Royal School of Mines, and Professor of Metallurgy in McGill University, Montreal, the work being a compilation in book form of a series of papers written originally for the "Canadian Engineer." The treatment of the electric furnace is complete indeed, while the numerous illustrations and attractive typographical appearance of the book make it a particularly desirable acquisition for any engineer's library. Price $2 net.

An arithmetic of electrical engineering for technical students and engineers has just been published by Whittaker & Company, London. The work contains 72 worked examples and 300 exercises, all these being of a character usually met with by the working student. To such the book should be of particular value. "Arithmetic of Electrical Engineering." Publishers, Whittaker & Company, London, E.C. Price 1s.

A very tastily printed catalog describing lighting magnets, published by the Electric Controller & Supply Company, Cleveland, O., has reached us. The illustrations are particularly good, while the general typographical appearance of the publication is distinctly praiseworthy.

"Integrating Wattmeters for Single-phase and Polyphase Alternating Current Circuits, and for Direct Current Circuits," is the subject of circular No. 1137, issued by the Westinghouse Company. This is a very complete and instructive publication on the subject of meters.

"Lifting Magnets and Recent Improvements in Them" is the title of a little booklet just issued by the Cutler Hammer Clutch Company of Milwaukee, makers of lifting magnets and magnetic clutches. The subject matter of this booklet originally appeared in Cassier's Magazine for October, 1907, which is now out of print. This little booklet which is printed in the form of a miniature magazine, traces briefly the development of the lifting magnet, illustrates the different kinds of magnets used for handling pig iron, metal plates and other classes of material and explains, by an easily understood analogy, how the magnetic "lines of force" support weights ranging from and to 10 tons. Copies may be had by addressing the Cutler Hammer Clutch Company.

From the Chase-Shawmut Company of Newburyport, Mass., we have received a copy of their bulletin and price list No. 101. This bulletin is one of a series which this company have been issuing for some time past and succeeds bulletin No. 100 which covered National Electrical Code Fuses, Cutouts and Fittings, Railway Cutout Boxes, Pocket Test Lamps, etc. Bulletin No. 101 is descriptive of the company's stage lighting appliances, including information on "Cushing" stage pockets and plugs, bunch lights and music light shades.

A tasty little booklet entitled "The Standard Accumulator" has been sent us by The Standard Electric Accumulator Company of New Jersey. A brief historical sketch of the storage battery is followed by a chapter on "The Standard Accumulator and Its Advantages." Numerous diagrams are introduced to illustrate the construction of the cell and to support the claims of the company that they have entirely eliminated the faults which up to the present time have been so closely allied with storage batteries.

A couple of pamphlets descriptive of New Weston A. C. switchboard instruments and Eclipse direct current switchboard voltmeters and ammeters have been forwarded us by the Weston Electrical Instrument Company of Newark, N. J. Attention is directed briefly to a number of points of superiority claimed by the company for their instruments, while illustrations and price quotations add to the serviceableness of the pamphlets.

CITY TO BUY TORONTO ELECTRIC LIGHT COMPANY'S PLANT.

At a meeting of the Toronto City Council, a few days ago, the question of approaching the Toronto Electric Light Company with a view to purchasing their plant was mooted by Controller Harrison. In his opinion the Council should address the Toronto Electric Light Company by letter asking permission on behalf of the city to send experts to ascertain the value of their plant, and also have auditors and accountants go through their books so that the Board of Control might form some idea of the value of their plant. Controller Harrison contended that the city should make the purchase at the actual value of the plant and allow a reasonable amount for the company's good-will. It was pointed out that the $2,500,000 voted by the ratepayers on January 1 would not be sufficient to buy out the plant and good-will, and that an additional $1,000,000 would likely be required, for which amount he supposed the Legislature and city would make provision.

An interview will therefore probably take place shortly between the company and the Board of Control, at which the question of purchase will be discussed.

WINNIPEG TELEPHONE COMMISSION.

The personnel of the Commission that will have entire control of the operation of the new government telephone system in Manitoba has practically been decided upon by the Ministers of the Crown, though as far as can be ascertained, the details of their powers are not decided, nor has the new Telephone Act been drafted. The three men who have been chosen are F. C. Paterson, manager of the northwest department of the Bell system, who will be made chairman; W. H. Hayes, assistant manager of the Bell system, who will have charge of the engineering work, and H. J. Horan, auditor of the northwest department of the Bell system, who will have charge of the same work now in his hands.

QUESTIONS AND ANSWERS

GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS:

1. All enquiries will be answered in the order received, unless special circumstances warrant other action.
2. Questions to be answered in any specified issue should be in our hands by the close of the month preceding publication.
3. Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment should be placed in the hands of a consulting engineer, cannot be considered in this department.
4. To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possible doubt as to the information required.
5. In all cases the names of our correspondents will be treated confidentially.

Question No. 1.—Can you tell me where I can get an electric heater to use in a show window for keeping the frost off the glass?

Answer.—We do not know of any special electric heater made for this purpose, though doubtless they could be obtained from any of the standard makers of electrical apparatus. The simplest way, however, to obtain your desired result is to use an ordinary electric fan. Just set it at any convenient point five or six feet away from the store front, and direct the air blast straight on to the glass. A comparatively short run at full speed will clean off the hardest frost, and after that you can kep the window clear, providing it is of a reasonable size, by running the fan at one of the slower speeds. The principle upon which the arrangement works is simply that the air delivered against the window, being from a warm part of the store, keeps the inside of the glass at a temperature high enough to prevent condensation.

Question No. 2.—When we came to read two single-phase meters which we have on a three-phase motor last month we found that one of them read a little less than it did before. Please explain the reason, or was there something wrong, and does this mean that we should get a polyphase meter?

Answer.—There is nothing wrong with the results you obtained, which are perfectly normal and will always be found when your motor runs at any power factor less than 50 per cent. Under these conditions, namely, a very lightly loaded motor, one of the two meters will run backwards. In such cases, to get your reading you have to deduct the indication of the low reading meter, or rather the difference between the present and last readings, from that of the other one, instead of adding the two together. The results given by two meters under these conditions are close enough for all practical purposes, though a polyphase instrument gives a more nearly correct reading. The error in the two meter combination is, however, very small.

Question No. 3.—What is the origin of the circular mill, and what is the relation between it and a square mill?

Answer.—A circular mill is a purely arbitrary or fictitious quantity, and as such probably originated or became standardized simply from custom, it being a very easy method of determining the relative, though not the actual, areas, of a wire of any diameter. These diameters being reckoned in lineal mills determined the unit to be used, namely, the mill, and as all ordinary wires are round the circular mill followed more or less naturally as a measure of relative areas. Probably if square or rectangular wires had been in use at that time the square mill would have been selected as the measure of area or cross section. Regarding the relation between the square and the circular mill we would say that the actual area in square mills of a wire one mill in diameter is $\frac{1}{2} \times \frac{1}{2} \times \frac{22}{7}$ (Radius $^2 \times \frac{22}{7}$), which figures to .786 square mills. As the circular millage of the same wire is 1, it follows that the square mill is .786 of a circular mill.

Question No. 4.—Is it really necessary to use a pantagraph trolley for high voltage single-phase equipments? If not, and a wheel trolley is satisfactory, why is the catenary form of construction always used for overhead work?

Answer.—Single-phase roads are as a rule installed in that form, instead of being equipped with direct current, because they are usually quite long, and consequently the copper required would be excessive unless higher voltages than those permissible with direct current apparatus were used. This higher voltage necessitates increased insulation, which cannot be obtained with ordinary construction, except at enormous cost, hence the reason for catenary overhead work irrespective of the form of collector used. It is also a necessity, from a mechanical point of view, if a bow trolley be used, because the latter, being comparatively heavy, cannot follow the variations in the height of an ordinary trolley wire quick enough to prevent heavy sparking. Besides this there is the question of clearances, which cannot readily be obtained with ordinary materials. The wheel trolley is quite satisfactory for use under catenary construction, providing that frogs are installed at turnouts, in fact, the trolley wire being very much more even in height, a wheel works better under a catenary overhead than it will under an equal grade of ordinary construction. On the other hand, single-phase roads being long roads, and therefore operating as a rule at extra high speeds, it is desirable to install a trolley which practically cannot come off. This requirement is filled by the pantagraph or bow form, besides which, the motion being entirely up and down, no swivelling being required, it lends itself readily to air control, which is rather better than handling by the ordinary rope, when the voltage is unusually high.

Question No. 5.—We have some recording wattmeters which were calibrated on 125 cycles, but which will shortly have to run on 60 cycles, as we are changing our generator. What will we have to do to them to make them correct, and what will be the result if we run them just as they are?

Answer.—The effect of the change in frequency, and consequently the work necessary to correct the error, depend entirely upon the design of your meters. If they are of the commutating form the change in frequency will not affect them at all, but if they are of the induction type the chances are that they will run a little fast, say 5 per cent. to 12 per cent., when you change to 60 cycles. You can probably correct this by moving the drag magnets to a new position, though in some meters certain structural changes are required, which can only be made in the factory. In addition to altering the position of the drag magnets, which is an adjustment used in connection with loads of high power factor, such as incandescent lamps, you will also have to readjust what is called the lag coil, the device that makes the meter record correctly on loads of low power factor, such as are lamps and fan motors.

AN ELECTRIC HIGHWAY.

In the January number of "The Inventive Age" appeared the following description of the long distance transmission line from Niagara to Syracuse, N. Y.:

"A great highway—in some respects the most wonderful in the world—stretches through the heart of New York State from Niagara to Syracuse. It is 160 miles in length and from 100 to 300 feet wide. It was extremely expensive to construct and it is patrolled night and day and kept constantly in repair. Yet the travelling public knows nothing of it. Never a wheel turns over its entire length and no one can see or hear anything passing along it. Nevertheless, it is a great highway, for over it constantly passes an invisible current of electricity strong enough to do the work of almost 100,000 horses.

"The construction of this road was a marvel of engineering. A private right of way was purchased, 300 feet wide at Niagara and 100 feet at the end of the line. This will permit the building of similar lines and the sending of power to other points. Great steel towers rise every 550 feet, except at curves, where they are set closer. Each tower weighs 3,000 pounds and is 55 feet high. Insulators, each weighing 75 pounds, are carried on the towers, and on these are supported huge aluminum cables which carry a current at a pressure of 60,000 volts. These cables have 19 strands each and were tested for every sort of strain before they were put into use. A private telephone extends the length of the line, with stations for messages at each fifth tower, and the line is regularly patrolled by a repair force. There are 11 sub-stations along the way, where the power is stepped down for industrial work. At each station, lightning arresters—or discharges of static electricity—are put in. All this is significant of the development of industries which will make Niagara the electric-power centre of the world, until the Dark Continent is civilized and the Victoria Falls made available for general power distribution.

CHILLIWACK, B. C., POWER ENTERPRISE.

The International Power Company, Limited, is the name of a new concern which is seeking water rights in the vicinity of Chilliwack, B.C., for the purpose of generating electric power. S. A. Cawley, secretary and treasurer of the company, has posted in the water commissioner's office an application for 20,000 inches from the Chilliwack river, to be diverted about half a mile east of the western boundary of Yale district, where the boundary line and the river intersect, and to be returned near the confluence of the Chilliwack river and Tomihy creek. According to the particulars furnished to Mr. Fisher, government agent, there is a drop of about 400 feet between the point of diversion and the place of returning, and the water will be harnessed by means of dams, ditches, pipes and flumes.

MARCONI WIRELESS DOING CANADIAN BUSINESS.

It is announced that the management of the Marconi Wireless Telegraph Company is prepared to accept messages in Montreal for transmission to the United Kingdom at the rate of fifteen cents a word. For some months past the Marconi Company has transmitted messages for newspapers by wireless telegraphy across the Atlantic, and since October 17 last, when the service was first started, there has been no interruption in it. This service will now be extended to ordinary commercial messages, in addition to press work.

It is understood that the Marconi Company have concluded a contract with the C. P. R. for the equipment of the steamers Lake Manitoba, Lake Erie, Lake Champlain, Lake Michigan, Montrose, Mount Royal, Montezuma, Montreal and Montfort with wireless apparatus.

SPARKS.

The percentage of earnings paid by the British Columbia Electric Railway Company for the last year to the city of Vancouver aggregated sixteen thousand three hundred, an increase of more than sixty per cent. over the previous year. The December payment was a record, being two thousand one hundred. The net profits for the year were $500,000.

A despatch from Nova Scotia informs us that the Micmac Gold Mining Company are planning the installation of a power plant for their mines at Bridgewater. It is understood that the plant will be built on a tributary of the La Have river, nine miles from the mines, where it is intended to build a dam 200 feet long and 15 feet high. Four hundred horse-power will be developed now and provision will be made for considerable extensions later. The company will need two waterwheels, two generators, motors, turbine pumps, electric hoists, drills, tools, mining machinery, nine miles of wire and about 500 cedar poles. It is estimated that the cost will be from $45,000 to $50,000. Work will be started on this project at once. The consulting engineer is P. H. Moore, of New York, N.Y., and the secretary, W. B. Arnold, of Boston, Mass.

Several firms tendered for the supply of electric pumps and motors for the Beach pumping plant at Hamilton, Ont. Engineer Sothman, of the Hydro-Electric Commission, recommended for the 25 cycle proposition the tender of the Geenral Electric Company for motors at $12,800 and the tender of the Buffalo Steam Pump Company for pumps at $7,600, making a total of $20,400. Mr. Sothman next recommended the tender of the Canadian Westinghouse Company for motors at $15,945, which with the Buffalo Steam Pump Company's tender would bring the total up to $23,545. For the 66 cycle proposition for induction motors Mr. Sothman recommended the offer of the Swedish General Electric Company for motors at $9,800 and the Buffalo Steam Pump Company for pumps at $8,500, a total of $18,300. It was decided to leave these tenders open and to call for fresh tenders for pumps.

Feb,

SPARKS

Chief Electrician Reid, of Moose Jaw, Sask., is reported to have tendered his resignation.

It is reported that the Mount Engineering & Electrical Contractors, Montreal, Que., have dissolved.

Subject to ratification by the Ontario Legislature, the town of Listowel will purchase the local company's electric light plant for $2,500.

The ratepayers of Berlin, Ont., have approved a by-law to raise $30,000 to extend the street railway system and electric light plant.

Edmonton, Alta., will install a new power plant, consisting of a gas producer engine of 1,000 horse-power and a 2,300 volt generator.

Application is being made to the Ontario Legislature for authority to issue debentures to the amount of $10,000 for improvements to the electric light plant at Napanee, Ont.

The Hamilton Radial Electric Railway Company have applied to the Government for permission to build and operate a line from Brantford to a point on the Detroit river at or near Windsor.

The surveys for the West Shore Electric Railway will be commenced shortly from Kincardine, Ont. Construction is expected to start in May.

The ratepayers of Goderich, Ont., have approved a by-law to guarantee $150,000 of the bonds of the Ontario and West Shore Electric Railway.

The Port Arthur city council have authorized the purchase of a 250 horse-power motor generator at a cost of $8,000 to provide additional power for the street railway.

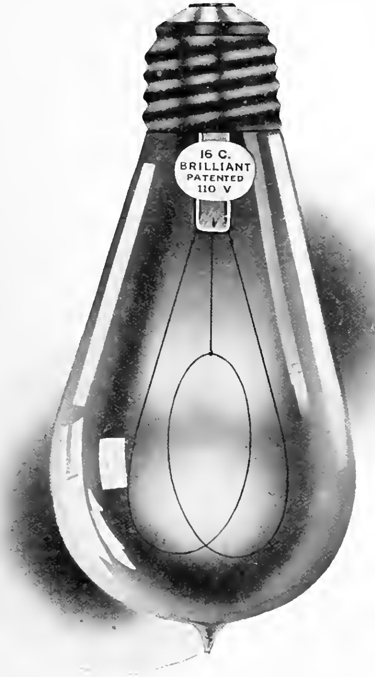
C. H. Topp, City Engineer of Revelstoke, B.C., announces that during the coming season the city will install a 400 horse-power gas engine and a suitable gas producer plant; also a 150 kw. dynamo to supply electric energy for power.

L'Ecole Polytechnique, in connection with Laval University, Montreal, have recently placed an order with the Canadian Fairbanks Company for a six horse-power special electric gas engine and 3 1-2 kw. direct current dynamo for experimental and demonstrating purposes.

It is announced that the Bell Telephone Company are contemplating extensive improvements to their Ontario lines, and that the bulk of the money recently received by the company in connection with the deal with the Manitoba Government is to be expended in and around Toronto as the centre of the province.

The Ottawa Electric Railway Company's receipts last year were $574,278, an increase over 1906 of $48,531. The growth of this concern has been remarkable. In 1892 the year's receipts amounted only to $71,000. The number of passengers carried during 1907 was 12,623,440, which was 1,215,218 in excess of the previous year. The company announce a dividend of twelve per cent.

Among the latest concerns to secure incorporation are the Van-Bergh Electrical & Manufacturing Company, Limited, with head office at Winnipeg, Man., capitalized at $250,000. The directors include H. J. MacDonald, K.C., H. Polson, Ashmore Kennedy, W. McMillan, H. R. Hollinshead, James Dodson, E. E. Yates and W. D. Pettigrew, all of Winnipeg.



The Brilliant Lamp

Just as good and perhaps a trifle better than any lamp made of its kind.

Manufactured by experienced help, with up-to-date machinery.

In buying Brilliant Lamps you get the benefit of our 18 years' experience as the only manufacturers of SOLELY LIGHT PRODUCING GOODS in Canada.

We could not make a better lamp if we wanted to. OUR KNOW HOW includes many wrinkles of our own—that means a good lamp.

ONTARIO LANTERN & LAMP CO., LIMITED

HAMILTON - CANADA

WIRES AND CABLES

OF EVERY DESCRIPTION FOR

Telephone, Telegraph and Electric Power Purposes.

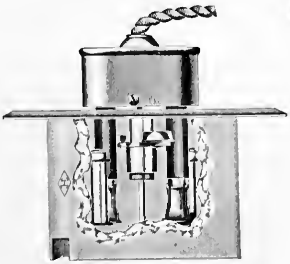
THE WIRE AND CABLE COMPANY, - - - MONTREAL

TRADE MARK

"Diamond H"

SWITCHES

Push Switches
Rotary Switches
Door Switches
Standard Switches



APPLIANCES

Galvanized Steel Wall Cases
Automatic Flush Receptacles and Plugs

MANUFACTURED BY

THE HART MANUFACTURING COMPANY, HARTFORD, CONN.

Canadian Agents: . W. Bongard Co., Limited 60 Wellington St. West, Toronto, Can.

Sparks.

The city of Toronto cannot undertake the running of a line of electric busses, according to the report of City Solicitor Chisholm in a letter to the Board of Control recently sent.

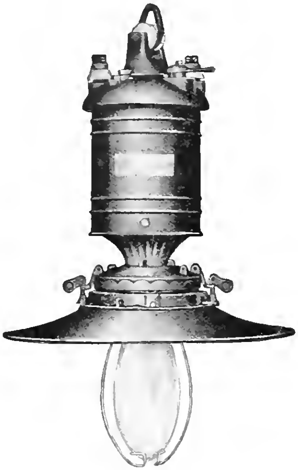
J. B. Gaughn, Brockville, Ont., is said to be promoting a scheme to build an electric railway along the banks of the St. Lawrence from Prescott a distance of sixteen miles. In this connection it is thought that a street railway and a summer pleasure park may be established in Brockville. British capitalists are said to be interested in these projects, which involve an expenditure of $1,500,000.

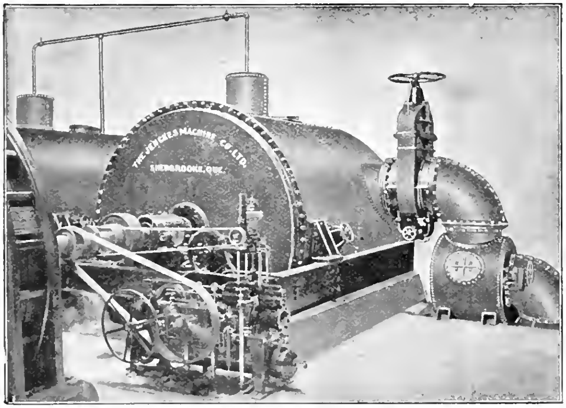
In the phraseology of a Montreal despatch, the new Robert Syndicate, who have been tendering for the city's lighting contract of that city, were recently given a "black eye" in the Court of King's Bench. The appeal of Vipond & Vipond against E. A. Robert and associates for control of the Montreal Electric Light Company was maintained. In the Superior Court, Mr. Justice Bruneau had declared Messrs. Robert and his associates duly elected officers of the company and entitled to control it. This decision has now been reversed, and Messrs. Vipond therefore assume full charge of the affairs of the company. There were originally five incorporators of the Montreal Electric Light Company, among them being the late Senator Ryan and Sir John J. C. Abbott. The Robert Syndicate had secured Mr. Ryan's share, and by so doing claimed to have secured also the Abbott interest by virtue of an entry in the late Sir John Abbott's books, recording the receipt of $500 for the charter of the Montreal Electric Light Company. Vipond Bros., however, had bought from Sir John Abbott's heirs all the rights and title to the share of the late Sir John Abbott, and contended that there had never been a previous sale. Both parties secured the interest of two of the original incorporators. The whole dispute arose over the Abbott interest.

MOONLIGHT SCHEDULE FOR APRIL.

Date.	Light.	Date.	Extinguish.	No. of Hours
Apr. 1	6 50	Apr. 2	5 00	10 10
2	6 50	3	5 00	10 10
3	7 00	4	5 00	10 00
4	7 00	5	5 00	10 00
5	7 00	6	4 50	9 50
6	10 50	7	4 50	6 00
7	11 40	8	4 50	5 10
9	0 30	9	4 50	4 20
10	1 10	10	4 50	3 40
11	1 50	11	4 50	3 00
12	2 20	12	4 50	2 30
13	2 50	13	4 50	2 00
14	No Light	14	No Light	
15	" "	15	" "	
16	" "	16	" "	
17	7 10	17	9 20	2 10
18	7 10	18	10 30	3 20
19	7 10	19	11 30	4 20
20	7 10	21	0 40	5 30
21	7 10	22	1 40	6 30
22	7 10	23	2 40	7 30
23	7 10	24	3 30	8 20
24	7 20	25	4 10	8 50
25	7 20	26	4 20	9 00
26	7 20	27	4 20	9 00
27	7 20	28	4 20	9 00
28	7 20	29	4 20	9 00
29	7 20	30	4 20	9 00
30	7 20	May. 1	4 20	9 00

Total............177 20





Pair of 35-inch Special Crocker Turbines, one of two pair, direct connected to generators. At station of Sherbrooke Power, Light and Heat Co.

CANADIAN
ELECTRICAL NEWS
& ENGINEERING JOURNAL

PUBLISHED ON THE TENTH OF EVERY MONTH BY
HUGH C. MACLEAN, LIMITED,
TORONTO, CANADA.

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362

MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative

WINNIPEG - - - - - - - Telephone 224. 330 Smith St.
ROLAND F. HILL, Representative

VANCOUVER - - - Telephone 2248. 615 Hastings St.
GEO. A. GALL, Representative

ADVERTISEMENTS.

Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.

The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

The Canadian Electrical Association.

As is announced elsewhere in the present issue, the Executive of the Canadian Electrical Association has selected Toronto as the scene of the 1908 Convention, and has decided that it will be held in June. It had been proposed that the gathering be held in Winnipeg, which would undoubtedly have been a good location from many points of view, but against it was the fact that owing to the great distance involved the expenses would be heavier than the Association cared to incur, besides which the trip would take too much time. Another point that naturally caused some discussion was that of September versus June, the latter finally being chosen. This action of the Executive will also doubtless meet with the approval of the great majority of the members, because as a rule operating men cannot afford to be away in the fall. Last year, in view of the Montreal Electrical Exhibition, was, of course, an exception, but as there is nothing of that sort this year the spring is undoubtedly the best time.

Now that the meeting place and the time have both been announced, it is incumbent upon each and every operating company to make such arrangements as are necessary to ensure that it is well represented at the Convention. The benefits of membership are obviously many, for instance, none but a representative and strong Association can effectively take up such questions as the Hydro-Electric campaign, the various legislation that may affect its interests, etc., etc. The results obtained by the delegation that went to Ottawa a few weeks ago regarding the fees for meter inspection is an evidence of what can be done in such matters. Obviously, it is unfair that work which is for the benefit of every central station should be left to the energies and the financial resources of but a few.

A. I. E. E. Standards for the Incandescent Lamp.

As time goes on practice changes quite radically on many important points, as witness the present methods of rating are lamps as against the original candle power specifications, or the permitted (sometimes even required) grounding of certain circuits as compared with the first rules about high insulation. Another change just about as radical as these two is that relating to the standards of light and the rating, etc., of incandescent lamps, as contained in the Institute Standardization Rules relating to that device. In the first place the English Parliamentary candle, which has hitherto been the legal standard, has been displaced by the Hefner amyl-acetate flame. This latter has for some time been the recognized standard in Germany, in fact throughout most of Europe, outside of England, so that the change but brings this continent into agreement with what is doubtless the better practice of the two. The Hefner candle is roughly 85 per cent. of the other, which accounts for the efficiency of the Tungsten lamp, which is largely a European development, being so frequently spoken of as 1 watt per candle. The candle thus referred to is of course the Hefner unit, 1 watt per candle on this basis, being just about equal to 1 1-4 watts per English candle, which is the efficiency that the Tungsten lamp is being developed at on this continent. The Institute specifies that our ordinary commercial candle power shall be known as 100-88 of the Hefner unit. Another very marked departure from present practice is contained in the section relating to efficiency, which is defined as the relation between the average spherical candle power and the watts consumption. This is of course a very proper change, because efficiency is universally expressed as the proportion between output and input, not input to output, as is the case when we speak of watts per candle.

Another valuable section is that relating to the comparison between lamps of varying shapes of filament, the rule being definitely laid down that the average spherical candle power shall be taken as the basis of comparison. This, being a measurement of the total light emitted by any lamp, is obviously much more proper than the average horizontal or the tip candle power, unless when comparing lamps having filaments of exactly the same shape.

It is, of course, unlikely that these alterations will at once come into general commercial use, because all current practice changes but slowly, but it is altogether probable that the introduction of the new high efficiency

lamps will result very largely in the dropping of the candle power rating as a commercial measurement, its place being taken by the total watts consumption. This is due to the fact that as electric lighting is now pretty firmly established on its own feet, there is not the same need as formerly existed for a basis of comparison between it and other illuminants, besides which it is the consumption and not the candle power that after all determines that most important point, namely, the central station's revenue and the consumer's expenditure. Further, the introduction of these new lamps means that all our present understandings of the relation between the light emitted and the energy consumed will have to be materially revised. This, combined with the fact that the candle powers of the smallest wattage lamps that it will be possible to make will be very much larger than have hitherto been used for ordinary incandescent lighting, will render the candle power of gradually decreasing importance. Hence it will probably disappear to quite a large extent as the ordinary method of rating an incandescent lamp, just as it has in the case of arc lamps. Legally speaking, though, it will have to be retained on the label of all lamps used in Canada, at least until the present Act is revised, as this latter at present calls for the candle power and voltage to appear on the label.

The Evasion of the Code.

It is a curious fact, and one frequently remarked upon, that very few of us see any crime in evading a customs officer, if we can manage to do so. But did it ever strike you that in the electrical trade there was an almost exact parallel to this, namely, that a large proportion of those engaged in it are always ready and anxious to beat the electrical law, as set down in the National Code. There are always arguments to be heard against the customs system and the restraints attendant on it, but no one seriously and openly opposes the Code, even to the extent of disagreeing with but part of its rulings, let alone the whole. Why then should we not all make an honest endeavor to comply with its requirements, and give it our hearty and honest support instead of trying to slink past with something that is just a little reprehensible, perhaps very much so. The Code should be looked upon as a guardian policeman, a valued protector, not as an avenger who is to be shunned and dreaded. Is it not incumbent on us to realize the error of our ways, and to mend them as fast as we can?

In the first place, the Code is not an arbitrary compilation which we must swallow willy-nilly, but the essence of the opinions of manufacturers, dealers, consulting men, and contractors. Suggestions as to changes are always welcome, in fact are sought after, and are thoroughly discussed and dissected before being put into operation. New Code rulings may sometimes look to be unnecessary, in fact irksome, but you can always depend that there is some good reason for the alteration or addition, otherwise they would not be there. This being the case, why should we not rest secure in the confidence that its compilers know what they are doing, and comply with it fully and freely, instead of doing only what is absolutely necessary to comply with the letter of the law, and then only under compulsion. Its sole aim and object is to make electric energy and electric light the best fire risks and the least menace to life that they can possibly be. Surely it is to the interests of all who are in any way concerned with electrical matters that this be accomplished. If the makers and distributors of coal oil could render it less hazardous than it now is, do you think that they would not gladly unite to do so? If the manufacturers of gas and gasoline engines could only arrange matters so that there would be next to no danger in the operation of their products, would they not hasten to take the necessary steps? Why then should not electrical men, employing as they do a materially less hazardous agent, gladly and willingly obey those rules which, if thoroughly observed, will almost absolutely prevent damage to property and danger to life from electric causes. Surely it is to their every interest to do so.

Then a word to the other side, to the policemen, so to speak, represented usually by the Underwriters. Enforce the Code, the whole Code, and—and this is most important—nothing but the Code. Local rulings, in one city calling for fuses below the switch, and in another above it, in the West calling loudly for slow-burning weatherproof, and in the East refusing it entirely, the Code notwithstanding, are obviously a source of bewilderment and aggravation. The Code is broad enough, and yet specific enough, it is complete enough, to stand on its own feet, let us all recognize that it is a friend, not an enemy, and stand shoulder to shoulder with it and each other, to the end that the electrical interests of Canada rapidly advance to their proper place. "United we stand, divided we fall," is never more true than of the present matter. A mob without a leader, a country without a ruler, a profession without its laws, are all impotent. Let us recognize this principle, and act the part of the true friend to ourselves and all others who have to do with the electrical art by supporting its Code.

Bell Telephone May Sell to Western Provinces.

At the annual meeting of the Bell Telephone Company of Canada, held February 27 last, it was announced by President Sise that the company is preparing to sell its plant and business in the Provinces of Saskatchewan and Alberta, provided that a proper agreement can be arrived at.

Mr. Sise stated that the Bell Company had no particular desire to sell, as they had already done in the Province of Manitoba, but that it was better to do this than to enter into competition with the Government.

The shareholders passed a resolution authorizing the board to deal with the Governments of these provinces for the sale of either one or both as being best.

High Voltage Insulator Manufacture.*

By Walter T. Goddard

Porcelain Insulators.

The transmission of power by means of electric currents of greater or less voltage, began with the introduction of the electric telegraph, and almost the first problem encountered was line insulation. It is of interest in this discussion to note that the first insulators successfully used were of porcelain. From that time to the present the progress has been rapid, the voltage having risen from two or three volts of the telegraph, to a present prospective line voltage of 150,000, and from the lowest to the highest it has always been recognized that best construction involved the use of porcelain insulators.

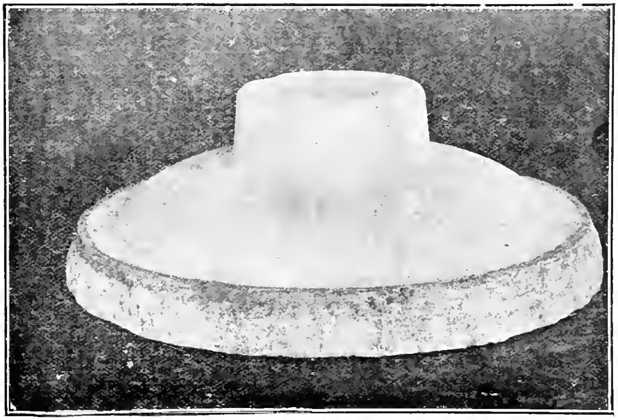


Fig. 1.

Fig. 6 shows sectional drawing of a high tension insulator made of several shells nested together and arranged to be fastened together by means of thin joints of Portland cement. This is the conventional design and is used for all voltages, though the size, number of shells, and shape may vary with the voltage. In general, American high voltage insulators are now made of several shells nested together, while European manufacturers still persist in turning complicated shapes from solid masses of dry clay.

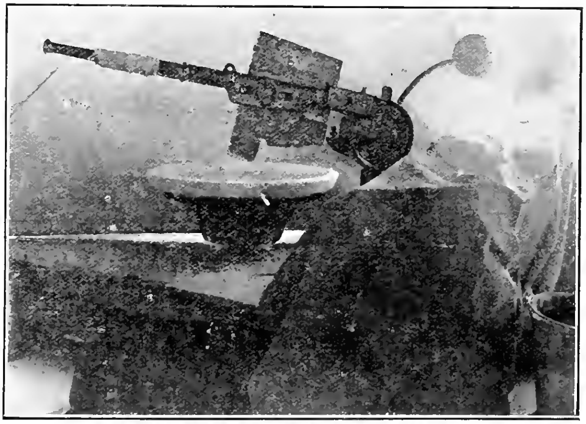


Fig. 2.

The manufacture of porcelain is one of the oldest arts, but only recently has it in any sense been placed upon a scientific basis; in fact, potteries for the production of electrical porcelain exclusively, have not been in existence for more than ten years, and during that time it has been necessary to develop an entirely new system of handling pottery products.

Porcelain for electrical purposes is a mixture of

* Paper read before the Electrical Section Canadian Society Civil Engineers.

ground flint or silicon dioxide and feldspar, or $(K_2O\ Al_2\ O\ SiO_2)$ potassium aluminum silicate, raised to virtrifying temperature, that is, to a temperature sufficiently high to melt the feldspar and permit it to unite the particles of flint into a perfectly homogeneous body of uniform electrical and mechanical strength. The production of electrical porcelain differs from the ordinary pottery product in that, in addition to presenting a symmetrical and flawless exterior, it must possess inherent electrical and mechanical strength.

Process.

Flint and feldspar occur in nature, as rock, which is reduced at the mine by grinding to a degree of fineness comparable to that of flour and of equal whiteness. The modern electrical porcelain potter mixes the proper proportions of flint and feldspar and again grinds the material in the presence of water in order to obtain intimate mixture. The mixture, or as it is dubbed in the factory, "clay," is separated from the excess water, immediately after leaving the grinding mills, by means of filter presses and afterward brought to uniform plasticity by means of kneading machinery.

The first step in the construction of an insulator is to build a model 16 per cent. larger than the required insulator, and from this model to make moulds of plaster of Paris. Fig. 1 shows a plaster model of a 60,000 volt insulator top from which the mould in Fig. 2 was taken. Each shell of a multipart insulator is treated in this manner, the inside contour of the mould being that of the desired shell. Fig. 2 shows a conventional power driven potter's wheel upon the top of which is fixed the mould partly filled with clay. The whole device is rotated rapidly and a forming tool whose profile is that of the inside shape of the shell under consideration, is forced into the mass of clay. A few revolutions usually accomplish the desired end and the mould with its wet and plastic clay is then placed in a hot room of approximately 130 degrees F. Within an hour the warm air and plaster mould have absorbed a large proportion of the water in the clay, and the embryo insulator may be removed from its mould and the rough surface, which originally rested against the mould, scraped smooth. The shell, as it may now properly be designated, is set aside for a period of ten days to two weeks in order that all water held by the clay be evaporated. If fired in this state the shell would come from the kiln hard, white and quite rough, of good dielectric strength, but with a surface which would gather and hold dirt and soot and, because of the extreme fineness of the irregularities, be practically beyond possibility of cleaning. For this reason, and no other, are the insulators covered with a glassy coating of extreme smoothness, capable of being washed by the gentlest rains. The glazing process is very simple. Immediately before being placed in the kiln, the insulator shell, which in its dry state is about as strong as blackboard crayon, is dipped into solution of clay and water and by virtue of its dryness absorbs a certain amount. On being heated the clay melts before the body vitrifies and so spreads very evenly over the entire surface. The presence of a small amount of iron in the clay is responsible for the brown color so generally used in this country, although any color can be obtained by the use of the proper materials in the glaze. The firing process is entirely a matter of temperature and its complications are all practical ones due to the large amount of material burned at one time and the difficulty of obtaining exact and uniform heat throughout the kiln.

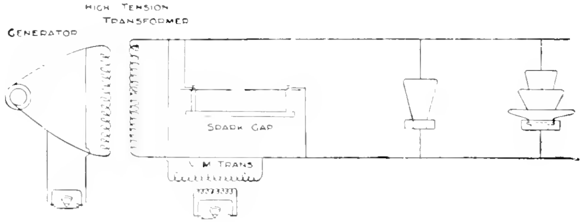


FIG. 3.

Mechanical and Electrical Testing.

The mechanical properties of porcelain are so varying that a sample test has always been deemed sufficient. On the contrary it is considered unsafe to permit any porcelain to go into service without testing each piece by means of a high voltage transformer. As will be explained later, the higher voltage insulators are made up of several shells, each of which is subject to a high voltage test of 50,000 to 60,000 volts. Fig. 3 shows the connections between the high voltage transformer and insulator shells to be tested. Fig. 4 shows this method as practised. The table is insulated from the floor by means of porcelain cones in order that high voltage may be applied to the wire embedded in the table top and designed to make contact with the pans arranged for the reception of porcelain shells. The pans are filled with water and so form one terminal of the high voltage. The other terminal is formed by water poured into the shell, attachment between it and the high voltage over-head conductor being made by means of small chains. By some controlling device in the low voltage side of the transformer, the voltage applied to the shells of porcelain is kept very near to arcing over, in most cases being about 55,000 volts. For ordinary commercial testing

the spark gap in air is usually employed when it is desired to ascertain the applied voltage. The number of failures is usually 2 per cent. or 3 per cent. of the number tested. When porcelain fails electrically the short powerful power arc through the very small puncture hole amounts to practically a short circuit upon the testing transformer and the excessive heat liberated in the porcelain often boils the water and destroys the shell. Once punctured, the porcelain is ruined and can by no method at present developed, be recovered.

The parts of multipart insulators are united by means of pure Portland cement mixed with water only. After

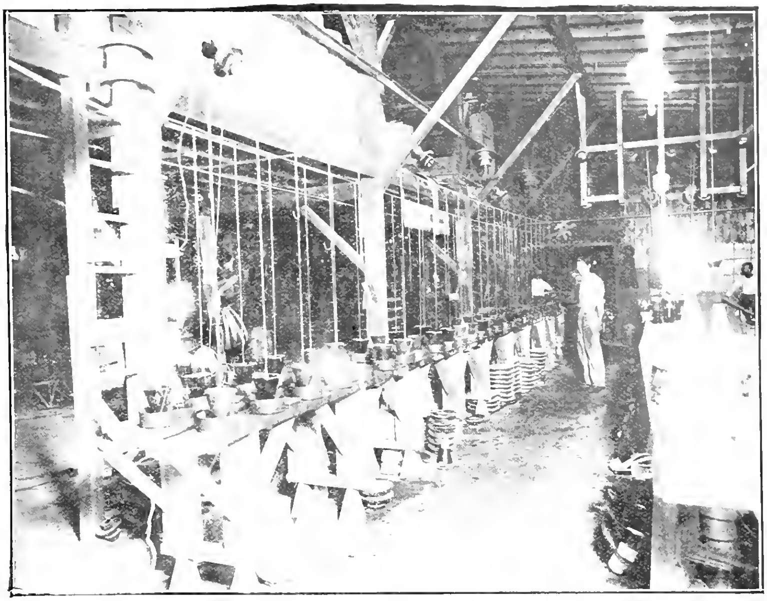


Fig. 4

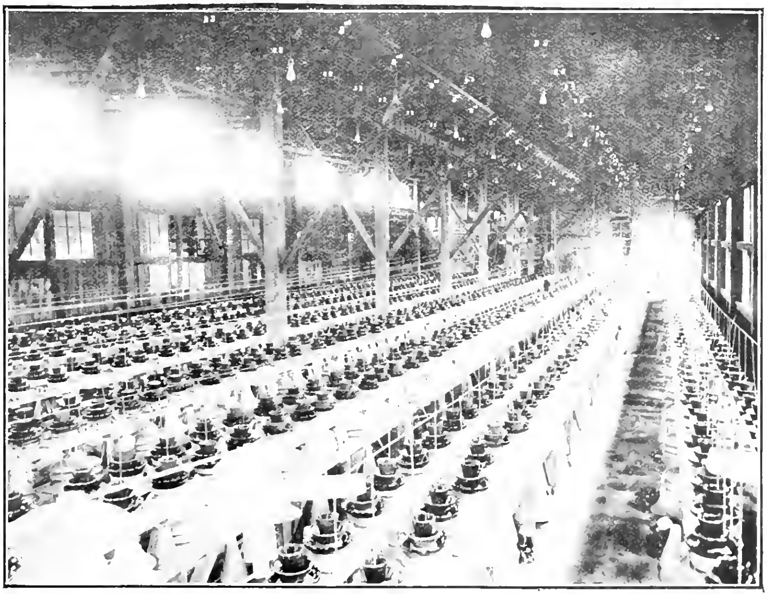


Fig. 5

the cement has obtained initial set the insulators are subjected to an assembled electrical test of double line potential for a period of time sufficient to remove all doubt as to the electrical strength of the insulators, usually from three to five minutes. To facilitate cementing and testing, racks, as shown in Fig. 5, are provided so that the operations may be performed with a minimum of handling. There is one very marked advantage in this manner of applying the assembled test voltage, and it is, that the voltage may be put on before the cement is dry enough

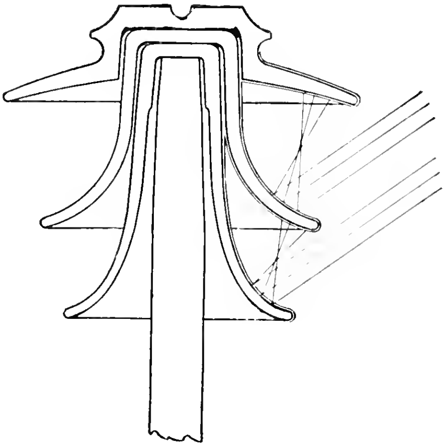


Fig. 6.

to permit handling of insulators, so in case of failure by puncture of any shell, it may be separated from the others without injury, a thing absolutely impossible once the cement becomes dry.

Design of High Voltage Insulators.

Insulators for the lower voltages call merely for the introduction of sufficient good material, between line and supporting structure, to prevent destructive leakage. For voltages up to 20,000, little or no difficulty is experienced in securing satisfactory insulation, but above that voltage it becomes not only necessary to have good material in plenty, but it must be properly distributed in order that the danger of puncture and severe leakage be reduced to a minimum. The manufacture of good porcelain from a mechanical standpoint forbids that it be made so vitreous as to resist a puncture test of 65,000 to 70,000 volts over 1-2 inch or 5-8 inch in thickness. It is vain to attempt to gain greater dielectric strength by increasing thickness, since inherent cracks in thick pieces really reduce the effective electrical strength to that of 1-2 inch or 5-8 inch porcelain. Accordingly, it has come to be recognized as best practice to make no attempt to manufacture the higher voltage insulators in a single piece, but rather to secure great electrical strength by multiplicity of parts. Though entirely possible to construct 30,000 volt insulators of one piece and still safely apply a double potential test, years of experience have demonstrated that a multipart insulator is much less liable to fail entirely, when struck by stones or bullets, than are single piece insulators and so prevents complete shut-down of the transmission line. By far the larger proportions of shut-downs on the modern transmission line come from mischieviously broken insulators. It is for this reason as well as for the greater normal safety factor that engineers are selecting multipart insulators at higher cost, even for the lower voltages. In general, two-piece insulators are used for from 10,000 to 30,000 volts, three pieces for from 30,000 to 50,000 and four pieces for the 66,000 and 70,000 volt lines now in operation. Above 70,000 volts the underhung or suspended insulator works out most economically and, for entirely different reasons, 8 or 10 shells of porcelain are introduced.

Considerations of puncture strength are the first concern of the designer. As before noted, good electrical and mechanical porcelain should be made of not more than 5-8 inch thickness, with an ultimate electrical strength of not more than 70,000 volts. To gain greater electrical strength it is necessary to introduce other shells which continue to add a proportional dielectric strength up to about 220,000 volts, at which point the curve gradually tends to become flat and becomes very nearly

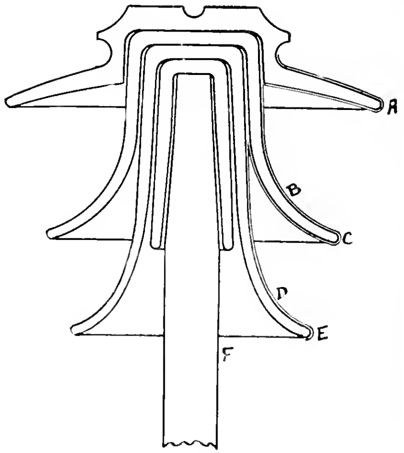


Fig. 7

so at 300,000 volts, so that it is apparently useless to utilize more than 5 shells unless some other condition is introduced. With this to start with it is a very simple matter indeed to provide economical insulators for any voltage up to the point where difficulty of manufacture begins to interfere with progress. The 10,000 and 20,000 volt insulators have little to do with puncture strength provided, of coure, that the porcelain is of good quality, and so the question reduces to an estimate of necessary leakage distance and carrying capacity when subjected to an artificial rain approximating the worst conditions to which the insulator will be subjected. This is not so simple as appears on the surface, for while an insulator

may behave admirably under a downpour of unprecedented intensity, it is vain to expect nature to limit herself to a vertical, or what is technically known as a 45 degree rain, nor does she stop after five, ten, or fifteen minutes, but is much more likely to accompany the downpour with sufficient wind to blow the rain very nearly horizontal, and to persist for any length of time. Under such conditions the insulator either meets its Waterloo or shows its mettle in the first fifteen minutes,

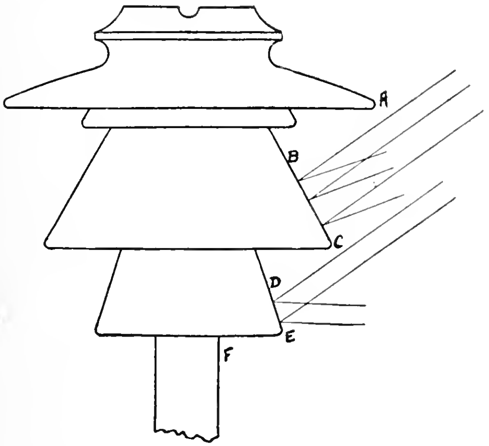


FIG. 8.

for at the end of that time all portions, except possibly the inside of the innermost shell, have become thoroughly wet and the surface leakage comes into play. As is well known, the persistence of any arc of definite length has to do with the voltage impressed and the current flowing, and the failure of an insulator is, of course, amenable to the laws which govern arcs. A designer should assume that his insulator will sometime become wet all over and should provide sufficient leakage resistance to prevent any considerable amount of current flowing, a small amount merely tending to dry off the insulator, whereas a large amount would quite likely start a disastrous arc under the shells and completely destroy them by its heat before extinguishing itself. Such an insulator represents very nearly the ideal and it is regrettable that so few lines are equipped with insulators of so great a margin of safety. It must not be forgotten that only once or twice a year are insulators called upon to perform extreme duty, in fact, the insulators of most lines are for the greater part of the time working very inefficiently, probably at not over 20 per cent. of their rated capacity.

The next best thing is to provide as much dry surface as possible under average storm conditions and, to this end, it is of value to note the progressive wetting of an insulator under rain. It is customary to mount the insulator well above the cross-arm so that all its shells are far removed from water spattering up from the arm. Assume an insulator of conventional design of three or four shells: The top becomes dripping wet at once and the film of water held on the surface carries line potential to the outmost diameter. A certain amount of rain gets by the top and strikes upon the lower shells, part spattering upward and part downward, depending upon the angularity of precipitation. That portion which spatters upward soon wets the entire under surface of the shells above and in this manner the potential is carried down to the lowest projecting shell. At this point the leakage path is broken, due to the fact that beneath the lowest shell there is no surface from which spattering may occur and consequently it remains dry, but under this condition the central shell of the insulator is carrying the total strain both as to puncture strain and against flash over. Fig. 6 shows clearly the effect of spattering, the double line indicating the surfaces covered by a film of water and thus carrying line potential down to the bottom of the lowest projecting shell. It may be further noted that between this double line, or line potential, and the pin, there is but one effective shell which has been subjected to but 60,000 volt test, and lines of very moderate potentials have strains of this magnitude between line and earth. The shells must, of course, remain wet till the storm is over or some drying-action is introduced. If the gap between the edge of the lowest shell and the pin is small enough a small arc will be established, thus completing the circuit and permitting a leakage current, formerly held in check by the dry inner surface of the shell, to flow, though limited in volume by the relatively high resistance of the pure water film covering the insulator. This leakage current heats and vaporizes the water film, its first action naturally being where the current density is greatest at the neck of each shell, where, fortunately, the surface is not subject to the direct force of the rain. Since potential is in no way concerned with resistance, the thinnest and consequently highest resistance film of water is sufficient to inaugurate the drying process, so that an insulator in service cannot be caught unawares and, if properly shaped, can care for itself.

From the foregoing it will be seen that the dielectric strength of the inner shell of any multipart insulator and the distance between its lowest edge and the supporting pin, are of utmost importance, the remainder of the insulator serving as little more than a resistence in series or leakage distance to limit the amount of current which may flow when arcing takes place. To provide against the first requisite it is merely necessary to introduce a protected shell, which cannot easily become west. This is shown in Fig. 7, as is also the great distance between pin and edge of lowest shell. What has been said applies to insulators as it is necessary to build them to meet mechanical conditions imposed, and it is the mechanical characteristics, not the electrical, which influence their cost. Were it possible to make porcelain wire of great strength, an insulator of perfect certainty of action could be produced at minimum cost. An insulator should not be regarded as a barrier to current, but rather as a high resistance path between line and

earth, and its design should aim to serve this purpose. Referring again to Fig. 6 and 7 it will be seen that as far as the ultimate strength of the insulator is concerned, the shape of the upper shells is of no moment, since they serve as series resistance only. There are reasons, however, why straight shells should be used and others equally good, why curved shells should be introduced, but the adjustment between the desirable points of one and the desirable points of the other call for fine discrimination. Figs. 6 and 8 show straight and curved shell insulators subjected to a 45 degree storm which spatters most vigorously in the direction shown by the arrows. Of these two insulators the straight shell would probably keep dry the longest since a large portion of the falling water is deflected away. On the other hand, the distances A-B, C-D and E-F are much greater on the curved shell type permitting it to carry much greater potential previous to its becoming wet all over than could the insulator of the straight shells. The curved shells will thus be better able to take care of sudden potential rises, when partly wet, than will those of the straight shell form. However, this partly wet condition does not last long, as there is often abundant enough precipitation to entirely wet the shells, and it is only then that the insulator can be assumed to be operating under full load, a condition for which it should be designed.

The foregoing applies equally well to low voltage insulators, though up to 40,000 volts it is hardly necessary to provide protection for the innermost exposed shell, since its own strength is entirely ample.

(To be concluded in April Issue.)

Wireless Telephony.

Wireless Telephony is an accomplished fact and at a recent meeting of the New York Electrical Society, Mr. Lee De Forest, the inventor, described the chief points of the system. In wireless telegraphy the disturbance of the ether which transmits the message is periodic, stopping and starting with the impulses sent out by the sending key, while in the case of telephony the wave which is transmitted through space must be continuous, but varying in value, that is, the degree of disturbance is varied, while the wave itself is continuous.

The principle of transmission is illustrated in Fig. 1. The so-called antenna consists of a number of wires running from the sending station through a considerable distance, either vertically or horizontally, and connected by an insulated wire to the transformer, through this to the transmitter and then to ground. The oscillator, which is in principle the singing arc employed by Duddell, has in parallel with it a condenser and inductance, the inductance in this case being the primary of a transformer, and choke coils are inserted between the source of current and the oscillator to prevent the vibration effect of the arc from being reflected back toward the dynamo.

The secondary coil of the transformer is connected into a transmitter circuit. It is arranged with a sliding contact so that the right amount of transformer may be used to give the maximum effect. By this arrangemennt a continuous series of waves is being sent out from the antenna, which is caught by the antenna at the receiving station, arrangement of which is indicated in Fig. 2.

Variation in strength of these waves acts upon a transformer at the receiving station, the sensitiveness and

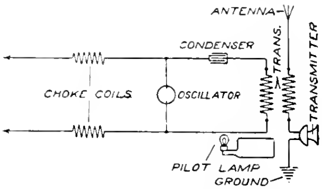


Fig. 1.—Principle of the Sending Apparatus.

frequency to which the receiver will respond being regulated by means of condensers and the current which affects the telephone receiver being carried through a device called the "Audion," which, in brief, is an exhausted bulb like an incandescent lamp, fitted with a tantalum wire having on one side a grid and on the other a wing of platinum. The tantalum wire is kept incandescent by a small storage battery and one leg of the secondary circuit is connected to the platinum grid and the other leg to one side of the tantalum filament. The telephone receiver is connected between the platinum wing and the other side of the tantalum filament. The action of the waves coming from the antenna and transformer is to vary the resistance of the gas in the bulb, thus varying the amount of current sent to the telephone receiver and reproducing with remarkable fidelity the tones of the human voice.

While the principle of operation of the system is extremely simple, the apparatus is rather complicated. The transmitter is filled with a microphone transmitting device, pilot lamps, switch key and sliding contact, the object of the pilot lamp being to indicate when the maximum condition of the waves is secured. An alcohol lamp is used to provide the flame and a nickel casing to contain the arc for the oscillator. Calling up for a

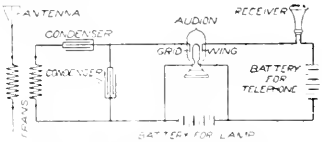


Fig. 2.—Arrangements of Receiving Apparatus.

distant station is accomplished by means of a Morse key and wireless device which operates the same as an ordinary telephone buzzer. The telegraph can also be used for spelling out any words which may be indistinct in the telephone. The receiving end of the installation consists of tuning coils mounted on an adjustable condenser, and a duplicate set of Audions, one being reserved for use in emergency.

Canadian Electrical Association Seek Reduction in Meter Rates.

As most of our readers know, the Dominion Government passed an Act some years ago providing for the inspection and testing of electric light meters, the object of such law being to protect the public against incorrect measurement of current. This Act, now known as "The Electricity Inspection Act, provides that the fees shall be regulated so that they will, as nearly as may be, meet the cost of carrying the Act into effect, the intention of the Government being that the service should not be revenue producing.

In earlier days electricity was sold quite generally on a flat rate basis, but to-day the meter is in almost universal use. The result is that the Government, having made no reduction in the schedule of charges for inspection, is deriving a large profit from the service.

The last annual report of the Inland Revenue Department shows the combined services of gas and electric light inspection to have produced a profit of $153,046.85 in less than eight years, after charging to expense certain amounts paid for standard instruments. The exact figures are given below:

Receipts and Expenses Electric Light and Gas Inspection, 1900 to 1907 inclusive (1907 for 9 months only).

Years.	Revenue.	Expenditure.
1899-1900	$35,523.50	$26,424.48
1900-01	37,536.57	28,247.20
1901-02	45,663.05	33,328.48
1902-03	49,054.55	36,006.47
1903-04	50,218.75	33,426.15
1904-05	62,561.37	34,774.02
1905-06	76,539.00	38,917.48
1906-07 (9 months) ..	57,868.18	30,793.84
Total, 8 years	$414,964.97	$261,918.12

The electrical companies have for a long time felt the burden of this inspection and anticipated a revision of the fees. The Government, however, took no action. The question was therefore brought up by Mr. A. A. Dion at the last annual convention of the Canadian Electrical Association, when a committee, consisting of Messrs. R. S. Kelsch, A. A. Dion, J. J. Wright, J. M. Robertson and A. A. Wright, M.P., was appointed to take the matter in hand and arrange for an interview with the Government. The president of the Canadian Electrical Association, Mr. R. S. Kelsch, elicited the co-operation of the gas companies in the movement, with the result that, realizing the benefits to be derived from organization, the Canadian Gas Association was formed. A joint deputation representing these two Associations interviewed the Government on February 12th. The electrical companies were well represented, an evidence that the burden of the inspection was felt keenly by both large and small companies. The deputation was introduced by Mr. Dion and was received most cordially by the Right Honorable Sir Wilfrid Laurier and Hon. Mr. Templeman, Minister of Inland Revenue. Mr. O. Higman, Chief of the Electrical Branch of the Department, was also present.

The object of the interview was stated briefly by Mr. Kelsch, who was followed by Mr. Dion and others. The following memorial was submitted:

Ottawa, Feb. 12, 1908.

To the Right Honorable Sir Wilfrid Laurier, P.C., G.C.M.G., K.C., D.C.L., Prime Minister of Canada, Ottawa.

Sir,—

We, the representatives of the Canadian Electrical Association, respectfully submit for your consideration the question of charges made by the Government for the inspection and testing of electric and gas meters.

Official reports for the combined services for the past few years show a steady increase in the excess of the revenue over the expenditure. This, in the fiscal year 1905-6 reached the enormous amount of 97 per cent.

For the seven years and nine months ended March 31, 1907, this excess amounted to $153,046.85, notwithstanding the fact that for several years the expenditure included large amounts used in the purchase of standard instruments for the use of the Department.

We take it that the purpose of this inspection of meters is to insure to the public correct measurement of gas and electricity, in the same manner in which the inspection of weights and measures ensures to the public correct weights and measurements.

The last official report of the Inland Revenue Department discloses the fact that the operation of the Weights and Measures Branch entails a considerable deficit, and we submit that if the Government is willing to accept this condition in order to protect the interests of the public in this matter, it is not consistent to charge fees for electric and gas meters that will produce such large excess of revenue over expenditure as is shown by the said report.

We believe that it was never the intention of the Government to make this service a source of revenue. The prsent conditions were brought about by the large increase in the use of electricity and gas meters, which was not anticipated at the time the fees were fixed. As a result the number of meters presented for inspection has largely increased, while the cost of the service has not increased in anything like the same proportion.

This state of affairs puts a heavy burden upon the electric and gas companies who have in addition to pay large fees for registration, tests for quality of gas, etc., and we respectfully submit that we are entitled to a very considerable reduction in the inspection fees.

Inasmuch as this service was intended to be only self-supporting, we think that if the fees were fixed at such figures as would quite cover the cost of the service, justice would be done to all parties.

A number of other grievances respecting the Inspection Acts and their operation were brought up from time to time by members of the Associations that we represent. These were considered, and although we do not wish to burden you at this time with these things, we would respectfully suggest that, as the Government availed itself freely of the advice of electric and gas com-

panies when the Acts were framed, and as the conditions in these industries change rapidly, it would be desirable that the Government designate some officer versed in these matters to whom grievances and suggestions could be presented from time to time, and as might appear advisable, and through whom the Government could keep in touch with the changes going on in these industries. This would, we are sure, be conductive to the greater welfare of all parties concerned.

This last suggestion shall, we trust, receive careful consideration from the Government, but it should not interfere with or delay the main object of this interview, namely, the request for a substantial reduction in the charges made by the Government for the testing of electric and gas meters.

Thanking you for granting us this interview.

We are, sir
Your obedient servants.

For the Canadian Electrical Association.
R. S. Kelsch,
President.

For the Canadian Gas Association.
H. H. Powell,
President.

The Minister of Inland Revenue frankly admitted that the Government had no desire to make a profit out of the service. He stated, however, that it was his aim to improve the efficiency of the service in every possible way, and this could only be done by the expenditure of money, a remark which met with the hearty approval of the deputation. No attempt was made to justify the large profit which was shown in late years, inasmuch as the Act itself establishes the principle that the fees are to be regulated to cover the cost only. The Minister authorized the announcement that the registration fee would be abolished immediately, and that the question of a revision of the inspection fees would be considered at an early date. There is reason to believe that the Government will make a substantial reduction. The kindred service of weights and measures earns less than 80 per cent. of its actual cost, while the combined service of gas and electric light shows a profit of almost 100 per cent.

"Circular Loom."

"Circular Loom," manufactured by the American Circular Loom Company, and for sale by the Canadian General Electric Company, Limited, Toronto, is a flexible conduit for electric wires. The manufacturers claim that it is thoroughly flexible, allows for the many bendings and twinings necessary in installation, while at the same time being tough and strong enough to escape collapse. It is moisture-proof and does not carry fire.

"Circular Loom" is composed of an inner layer of fibre, around which is wound rubber tape, to ensure water proofness. Outside the rubber is a woven covering of heavy cotton, treated with a moisture repellant compound.

Canadian Electrical Association Convention.

A meeting of the Managing Committee of the Canadian Electrical Association was held at Ottawa on February 12th, to make preliminary arrangements for the annual convention. It was decided to hold the convention in Toronto on Wednesday, Thursday and Friday, June 10th, 11th and 12th. A committee was appointed to make the necessary local arrangements to secure papers.

The convention in Montreal last year, was in many respects the most successful in the history of the Association. It is hoped that the forthcoming convention will show further progress, and every member is requested to co-operate to that end. Toronto is to-day very interesting from an electrical standpoint, owing to the recent introduction of Niagara power.

Preventing Static Interference.

A novel means of preventing the static interference of single-phase electrical operation with railway telegraph lines along the right of way has been applied on the recently electrified division of the Erie R. R. between Rochester and Mt. Morris, N. Y. In the application of a system to prevent the telegraph relays from chattering, it was found desirable to "pacify" the instrument by auxiliary devices and connections, rather than to attempt to compensate for the electro-static and electromagnetic induction from the propulsion lines, and this is accomplished by using 150 ohm back-contract relays with 350 ohm sunts across their line terminals, each relay making a connection on its back contact at each opening, though an auxiliary circuit containing a 7 volt battery and 500 ohm resistance. The 350 ohm shunt, is in the form of a non-inductive carbon stick resistance and is effective in offering an easier path for the electro-static than the relay magnets; but the resistance is low enough to render the relay's action noticeably sluggish in action. This sluggishness is compensated for by the insertion of the battery in the auxiliary circuit, which, when the relay is open, throws additional battery onto the line and assists its relay in responding to the key at its home or any other station. The shunt resistance must, however, be adjusted at different locations on the line as the effect of the interference is greater near the battery and ground, and the resistance must be less.

Switchboard Instruments.

From the John McDougal Caledonian Iron Works, Montreal, we have received bulletin No. 102, illustrating several well-known installations of Worthington multistage turbine pumps. The bulletin may be had of the publishers on request.

Messrs. Sanderson & Porter, consulting engineers, 52 William street, New York, announce that Mr. Wynn Meredith has been admitted as a member of the firm and will take charge of their Western office, Union Trust Building, San Francisco.

Power Equipment of Windsor Essex and Lake Shore Railroad.

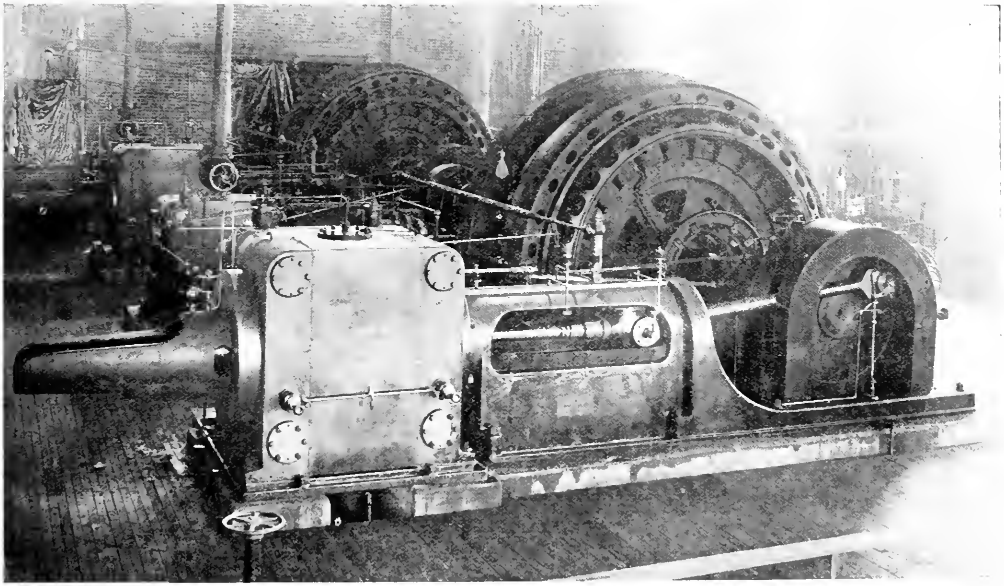
Goldie & McCulloch Cross Compound Corliss Engines Used.

The power plant of the Windsor, Essex & Lake Shore Railroad, described in our issue of last month, is illustrated by the accompanying photograph and diagram.

Each main unit comprises a Cross Compound Goldie-Corliss Engine, built by the Goldie & McCulloch Company, Limited, Galt, Ont., direct connected to a 500 kilowatt Westinghouse generator. The engines have cylinders 20 and 40 inches diameter by 36 inch stroke, and run at a speed of 125 revolutions per minute. The rated capacity of each engine is 750 I.H.P., with a maximum overload capacity of 60 per cent. above the rated load. The valve mechanism is the Goldie & McCulloch type for high speeds with steam actuated dash pots and double eccentric motion. This latter arrangement allows a long range of cut-off and consequent high overload capacity. The engine frames are of the heavy duty type and are cast in one piece and rest on the foundation for the entire length. The main bearings are 15 inches in diameter by 27 inches long, and the flywheel is 14 feet in diameter and weighs 32,000 pounds. These flywheels are of sufficient capacity to enable the 25 cycle generators to be run in parallel. The ease with which the generators on this type of engine are paralleled is due in a great measure to the governor employed. This governor is of the Rites Inertia type and is especially designed for this service. The pulley for driving the exciter is also mounted on the engine shaft.

Each engine unit is lubricated by a Richardson's automatic oiler and a White Star continuous oiling system, supplied by the Pittsburg Gauge, Valve & Supply Company. The flywheels weigh 14 tons and the engine is provided with a belt-driven governor. The engine room is of sufficient size to accommodate a third unit.

Each of the two engines has a jet condenser equipment and pumps supplied by the Canada Foundry Company. These condensers are located in concrete pits below the basement floor and close to the heavy concrete foundations of the engines. The condenser pumps draw their water from Lake Erie.



Cross Compound Goldie Corliss Engine, Direct Connected to a 500 Kilowatt Westinghouse Generator.

Electric Generators.

Each of the engines just described has mounted on its shaft the field of a 500-kilowatt 25-cycle single-phase 3-wire flywheel type generator, built by the Canadian Westinghouse Company, Limited. The windings of these generators are such that from the terminals may be obtained current at 13,200 volts pressure and at 6,600 volts pressure. The two windings may be used in series for obtaining these two voltages or may be connected in parallel for obtaining the full capacity of the machine at 6,600 volts. One of the three terminals of each machine is grounded. The exciting current for each generator is furnished by a 30-kilowatt 125-volt belted generator, the field current of which is varied by a Tirrill regulator to obtain a smooth voltage regulation for the large units.

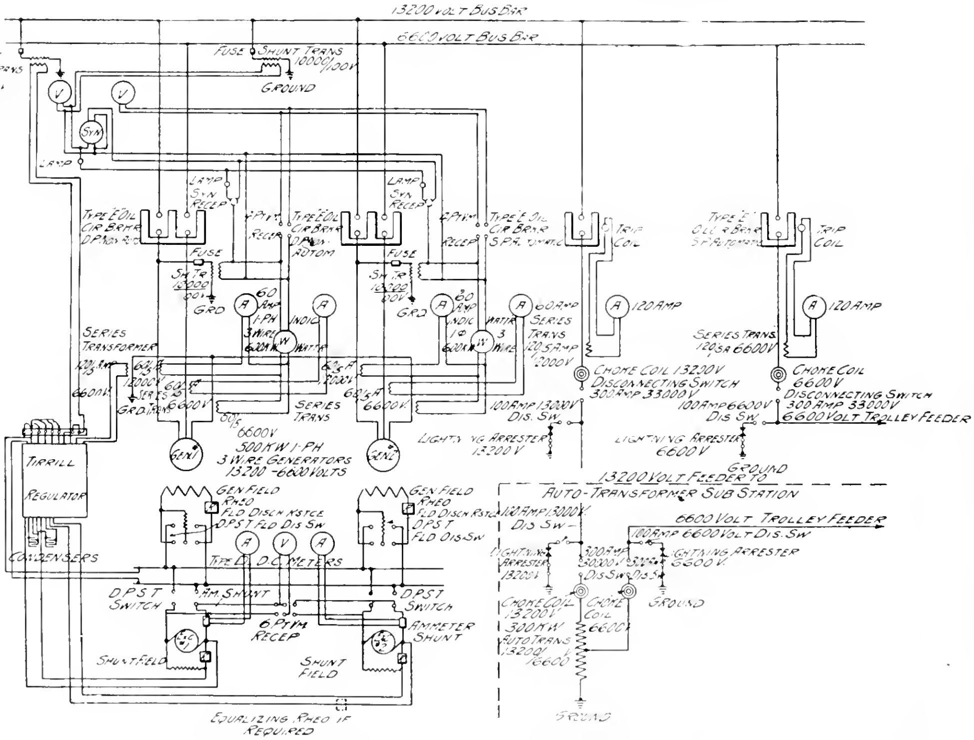
A wiring diagram is presented showing the principal electrical connections of the two generators and auxiliaries in the Kingsville power station, together with the connections of the 13,200-volt feeder and the single autotransformer substation which feeds a distant part of the

6,600-volt trolley line. It will be noted that the two 3-wire generators feed each of two buses, one carrying current at 13,200 volts potential and the other at 6,600 volts potential. The bus of the lower potential feeds direct to the trolley wire, while the one of higher potential feeds a single-wire transmission line serving an auto-transformer substation located at Maidstone, 18 miles from the power station.

The switchboard for regulating and controlling the output of the Kingsville generating station comprises five panels: one exciter, two machines, one 6,600-volt feeder and one 13,200-volt feeder. The auxiliary switch-

Cancelling Orders for Rolling Stock.

On all hands it is announced that railways have cancelled their orders for rolling stock. For the past few years, when it was pointed out to the transportation companies that their rolling stock was inadequate to the demands of their patrons, the reply invariably was that the manufacturers of rolling stock had orders for a year ahead, and that the railways were buying all the rolling stock that it was possible to get hold of. Now what should be the present policy of the railways? Should the rolling stock factories be working on short time? As soon as this little sag in business is over the demands on



Power Station Wiring Diagram, Showing Main Connections for Two 3-Wire Single-Phase Generators, Transmission Line and Auto-Transformer Substation.

board equipment includes a synchroscope. The switchboard is an angle iron and gray marble structure standing on a foundation of concrete, comprising three reinforced posts. Enclosed in concrete cells back of the switchboard are two machine and three feeder switches. These are distant-controlled oil-break type E twitches. The high-tension wiring within the station is comprised of lead covered cable enclosed in fibre conduit.

Messrs. Gordon & Helliwell, Toronto, were the architects of the Kingsville power station. The Canada Foundry Company supplied and installed the mechanical installation, and the Canadian Westinghouse Company, Limited, supplied and installed the electrical equipment.

the railways will revive in greater magnitude than ever, and every road will be short of rolling stock

Public Ownership Undesirable.

In the Senate on February 25th last, Senator McMullen moved a resolution declaring that public ownership and operations of public utilities would not be in the interest of this dominion. The management of municipally-owned public utilities in England was expensive, and the increase of municipal debt since the movement began showed this. In Glasgow the rate increased from twelve cents to fifty in 1890, to sixteen and a half cents at present. Canada had a warning against public ownership in the Intercolonial.

QUESTIONS AND ANSWERS

GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS:

1. All enquiries will be answered in the order received, unless special circumstances warrant other action.
2. Questions to be answered in any specified issue should be in our hands by the close of the month preceding publication.
3. Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment should be placed in the hands of a consulting engineer, caot be considered in this department.
4. To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possible doubt as to the information required.
5. In all cases the names of our correspondents will be treated confidentially.

Question No. 1.—Will you give the following information through the columns of THE CANADIAN ELECTRICAL NEWS, viz., the best manner to tie the larger sizes (No. 0, No. 00, No. 000, No. 0000 B. & S.) of weatherproof and rubber-covered copper wires to insulators when the pressure is from 250 to 500 volts, giving the sizes of the tie wire and the length of the tie wire that has been found to be most satisfactory?

Also the best way to tie the wire when the wire is in the top groove and when the wire is on the side groove. Very little information is given in the standard works and technical press on this point. I have built hundreds of miles of telegraph, telephone and power lines, so I am not without a little experience on the subject and I am still seeking the best plan.

Answer.—The best tie for any of the larger weatherproof or rubber-covered wires is a piece of No. 8 or No. 6 weather-proof wire, the latter size preferred. For tying in either the side or top groove (the latter being the better position if the insulator is built with a grooved top) take a turn first round the insulator, then two or three times round the wire, then back round the insulator again, twisting the two ends of the tie wire together. It takes about 14 to 20 inches of tie wire per fastening.

Question No. 2.—In shutting down a motor, should you pull the rheostat handle over as soon as you open the main switch, or should you wait and let it fly off by itself? Why does it not spring open as soon as you pull the switch?

Answer.—As long as you are sure that your rheostat is in proper condition, so that there is no danger of the arm sticking in any intermediate position, the proper way is simply to pull the main switch and let the rheostat open itself. The reason that it hangs on for a little while, and does not fly off at once, is that the motor, as long as it is revolving, is acting as a generator, and thus keeps a current flowing in the field circuit. It is not until the motor has slowed down considerably that this current grows small enough to weaken the retaining magnet and thus let the arm go.

Question No. 3. Not long ago I received a circular from one of the Underwriters' inspectors (not the Toronto branch), saying that slow-burning weatherproof wire could no longer be used indoors, as it was suitable only for outdoor use. Is that right, and can such a ruling be enforced?

Answer.—As far as we can see the ruling is quite contrary to the Code, which in Rule 24b specifically enumerates slow-burning weatherproof wire as one of the permissible insulations for open work in dry places. Further, Rule 42, which is the one detailing the make-up of this wire, states plainly that it is not suitable for outside work. In view of this the circular of which you speak appears to be exactly contrary to the Code, and therefore one which cannot be enforced as being based on good and current practice. On the other hand, the Underwriters are, of course, entitled to refuse risks which do not come up to their requirements, irrespective of whether these latter be reasonable or arbitrary. However, the competition for business will undoubtedly prevent the rulings of any one company, or even a section of the association, from becoming too onerous.

Question No. 4.—Would you please give an explanation of the term "mean spherical reduction factor," as applied to incandescent lamps?

Answer.—Incandescent lamps are usually rated by measuring the light which they give off at right angles to the main axis of the lamp. This comparison, however, is only fair when the filaments are of exactly the same shape; consequently you have to get some other basis when you are comparing lamps of different styles, such, for instance, as the regular double oval and a coiled filament, like that used in the Radiant Shelby. Obviously, the best and fairest basis is the total light omitted in all directions, or the average of this, which is known as the mean spherical candle power. But it takes a lot of very careful measuring to determine this accurately, and so a set of fractions has been worked out by the use of which the mean spherical candle power of any style of filament can be found at once from the average horizontal candle power, it being of course a simple matter to measure this latter with the ordinary photometric equipment. This fraction is what is known as the spherical reduction factor. It is about 82-100 for the ordinary double oval filament, from which it will be seen that the average spherical candle power of what is ordinarily known as a 16 candle power lamp is about 13 candle power.

To Investigate Swiss System.

Mr. Roderick J. Parke, electrical engineer of Toronto, has left for Europe to visit the more important electric lighting and power systems in England, France, Italy and other countries. The special object of his visit is to examine the new direct current system of long distance transmission installed between Moutier, a small village on the Swiss border, at which place there is an important hydro-electric development, and the City of Lyons, a distance of 110 miles. Power is transmitted between these points by direct current, and it is Mr. Parke's intention to study this system from the standpoint of its applicability to Canadian transmission.

Reorganization of Science Faculty at McGill.

It is probable that the near future will see a great change in the Faculty of Applied Science at McGill University. At the present time a special committee is engaged in investigating existing conditions, providing for the re-arrangement of the curriculum of studies for the several branches of the department, and studying the curricula of leading technical schools on the continent.

Dean Bovey, who has been for thirty years head of the Faculty of Applied Science, has resigned and leaves for England shortly to accept one of the most eminent positions in the gift of his profession, the rectorship of the Imperial College of Science and Technology in London. Upon Dean Bovey's successor will devolve much of the responsibility of reorganizing the faculty.

While it is an acknowledged fact that the place taken by McGill science graduates ranks second to none on the continent, yet there has been for some time an uneasiness among the students, particularly those of the third and fourth years, who claimed that the arrangement of their courses entailed too little unity, and that the system of practical work especially was not of the best. This feeling had found expression at various times, and never more forcibly than at the close of the last session, when Mr. Lawrence Killam, in reading the valedictory address of the graduating class in science, complained bitterly of the valuable time wasted in the course.

The authorities of the University immediately determined on an investigation of the difficulties which the lack of intimate relationship between professors and students, now happily in a fair way to be obviated by the formation of the new Students' Council, had hitherto prevented them from ascertaining with any exactness. A committee of five members of the Faculty was therefore appointed to look more carefully into the needs of each division of the students in the Faculty to find wherein lay the difficulty and where the remedy. This committee was composed as follows: Dr. H. T. Bovey, Dean of the Faculty; Prof. C. H. McLeod, Professor of Civil Engineering; Prof. J. Bonsall Porter, Professor of Mining Engineering; Prof. R. J. Durley, Professor of Mechanical Engineering; Prof. R. B. Owens, Professor of Electrical Engineering.

It is thought that the work of the committee may be a re-arrangement of the officers of instruction also. There is already an important post in the faculty vacant, the professorship of chemistry and the directorship of the Macdonald Chemistry and Mining Building, formerly held by the late Dr. B. J. Harrington. There will also now be the deanship.

Conjecture is already busy with the name of Dr. Bovey's successor. Whether or no the final choice will fall upon him, the name of Professor C. H. McLeod will at least receive very careful consideration.

There are over 14,000 subscribers using the telephone system in Manitoba, which the Government of that province have purchased from the Bell Telephone Company.

MacKenzie Controls Electrical Development Company.

Without a dissenting voice, and with $4,800,000 of the $6,000,000 common stock voting in favor and not a single proxy against, the control of the Electrical Development Company passed into the hands of Mr. Wm. MacKenzie and his associates in the Toronto Railway Company on February 26th last.

A special meeting of the shareholders was held, presided over by Sir Henry Pellatt. Sir Henry, in addressing the meeting, said the company had been harassed by the government, the hydro-electric power commission and the municipalities; that it had been found impossible to sell two million dollars' worth of bonds. In this state of affairs the shareholders were fortunate in having such an offer submitted from Mr. MacKenzie. The arrangements were such that the dividends due on the bonds on the first of the present month were provided for, while the earnings of the company were sufficient to meet all charges, including interest and working expenses.

It is thought in some quarters that there is a probability of the Hydro-Electric Power Commission and the Electrical Development Company coming to an understanding, and the commission taking over from the company the contract for the supply of power and disposing of the power to the City of Toronto at the same rates. If this were done the Power Commission would not need to erect a power line from Hamilton to that city to supply power, at least not for some time, when the business would be largely increased. The possibility of the commission making a deal with the Electrical Development Company was inferred from the request of the Commission to the city Board of Control that the board should not meeet the Toronto Electric Light Company again until the Commission and Board had had another conference.

Toronto Electric Light Company.

At the twenty-fourth annual meeting of the shareholders of the Toronto Electric Light Company, Limited, held at the head office of the company, in this city on February 11, the report of the directors for the year ended December 31 showed an income of $1,039,716.42. The expenses, including interest on debentures, amounted to $651,925.57, leaving a balance to profit of $387,790.85. Out of this there have been paid four quarterly dividends at the rate of eight per cent. per annum, amounting to $245,503.39, leaving a balance of $142,287.46 to be carried forward to profit and loss, bringing that credit up to $160,314.89. During the year a large proportion of the change has been made from the steam plant to power apparatus. As both systems have been more or less used in operating, the percentage of expenses to gross receipts has been somewhat larger than would otherwise have been the case.

The Municipal Ownership of Public Utilities vs. Private Enterprise.

In our sketch last month of the proceedings of the Canadian Society of Engineers, who held their annual meeting at Montreal from January 28th to 30th last, some brief excerpts were made from the address of the retiring president, Mr. W. McLea Walbank, B. A. Sc. Since that time the complete address has been forwarded us, and as many of our readers are interested in the subject of "Municipal Ownership of Public Utilities v.s. Private Enterprise," upon which subject Mr. Walbank is more than usually competent to speak, we have reprinted his remarks in full:—

The Institute of English Bankers a short time ago attributed the widespread depression that existed in England at that time, to the engagement in municipal trading. They pointed out "That it had been productive of many evils, such as the elimination of personal initiative and enterprise, evasion of the natural laws of commerce, the creation of a favored class of labor. It has brought corruption in politics, and partially eliminated in many directions any further attempts to engage in private industry."

The country has been after the corporations recently to such an extent that we have been unnerved, tired of leading such a life, and seek rest. The losses in credit and value of money during the past year have been untold. Even those that have safety deposit boxes full of securities, through lack of credit are unable to obtain money to carry on their works, so necessary at this time of the year, to give employment to those who will otherwise feel the pinch of hunger.

The recent panic was not a rich man's panic, not even an industrial panic; it was a financial panic, which every man, woman and child is bound to feel the effects of. We have been attempting too big a business with too small a capital. As long as there was confidence and its resulting credit, a small amount of money accomplished wonders, but destroy that confidence, replace it with distrust, and a large amount of money accomplishes but little. There is not sufficient money in this country to carry on business, if actual cash must pass from hand to hand. A short time since our industrial conditions were all that could be desired; but a spirit of unrest and discontent had appeared. The working classes are arrayed against capital. The professional agitator is seeking new recruits, and political interest knows no law but to succeed. Votes are gained, business may suffer, may even go to the dogs, but who cares? Corporations can be taxed; that is what they are there for. I do not wish to be understood as saying that corporations are not in a measure responsible for this state of affairs. When we read of great railroads giving secret rebates, enriching the recipients and suppressing competition in the interests of individuals, of the enormous amounts of cash and bonds in the hands of insurance companies, of how large companies are promoted and their capital inflated by their organizers giving large bonuses of common stock to those who subscribe for its bonds—is it any wonder that labor rebels and becomes arrayed against capital?

Is their condemnation of wealth, trusts, and corporations justifiable? Have they forgotten that it is from these sources that the people at large have derived hospitals, colleges, museums, special chairs of learning, and other beneficient uses too numerous to mention? I think that a close examination of most gas, electric and public utility companies will reveal the fact that the public and taxpayers in general derive more benefit than do the ordinary shareholders, whose money has made these possible. To those engaged in the management of electric and gas plants, it seems impossible that the clamor for the municipal ownership of these utilities, based on the theory that municipalities can produce these commodities as cheap, or nearly as cheap, as the corporations, can be founded on fact.

You must realize that self-interest and the interest in getting returns on investments, point towards the economical management of large enterprises, and while we may not be beyond reproach or criticism, many of the so-called evils are the result of unwise legislation. Ill-advised efforts are made by governing bodies through legislative assemblies, to secure advantages over corporations that can only result in causing the investor to feel that his interests are being attacked, and causes him to resist such legislation, the result being a feverish agitation between the would-be perfecter of civic government and the owners of corporate properties, without either party reaching a satisfactory conclusion.

If so-called reformers would only take the trouble to investigate carefully both sides of the problem, many of the supposed evils would disappear, and all they would have left to work upon would be the substitution of civic or political management in lieu of industrial management. The civic politician sees an easy road to office through catering to and fanning the flame of public discontent, to which "yellow journalism" has given birth. He sees votes and therefore shouts for municipal ownership indiscriminately. He never loses an opportunity in season and out of season of pointing out how wretchedly our companies are managed, and how extortionate are the tolls that are extracted from the public, compared with the rates that might be expected if Mr. Alderman had the managment. He sees great possibilities of extending his patronage by an increased list of employes, and the expending of vast sums of money, while the average citizen things he sees a favorable opportunity to obtain a necessary commodity at a greatly reduced cost. Were a referendum taken, I have no hesitation in saying that the majority of citizens, unless they were property owners whose lands would have to pay the cost in taxes, would vote for free gas, free electric light, free telephones, free street railway service, free groceries, free newspapers—in short, all the necessaries of life free of cost.

In pointing out the fallacy of municipal ownership, Mr. M. J. Francisco, an engineer, who has devoted a great deal of thought and study to the question, in his work on the subject says:—

"The whole foundation of municipal ownership is

based upon the assumption that inexperienced hired employes of a city who have not a dollar at risk, and in many cases have been given the position as a reward for helping some political aspirant to office, can and will run the plant and manage the business more successfully than the members of a private corporation, notwithstanding the latter may have nearly all their property invested in the enterprise, and a failure means ruin to them. It is not reasonable to suppose that men under such conditions will give closer attention to business and investigate every branch and detail of its work? It is a well-established axiom that the more a man has at risk the closer attention he gives to details.

"It is well known that municipal ownership is purely and simply a political move to secure votes for some aspirant for office, and that it is used for this purpose regardless of any other question. Parties have publicly announced that they are using it as a plank upon which to stand while they gather in the votes.

"It has become a well-established principle with both parties that civic government is the lawful spoils of the victorious party. Is it for the purpose of getting the votes of the laboring class that lower rates of taxation, with shorter hours and higher wages, are promised, but these are forgotten as soon as the election is passed, as was shown in Detroit and other places.

"When the advocates of municipal ownership find themselves unable to disprove the facts disclosed under municipal management in this country, they immediately fall back upon Glasgow and the wonders achieved there by municipal ownership. The conditions are not the same in Glasgow as are found in the United States. The government is entirely different, and the political situation that exists in this country is not found there. Wages there are less than half those paid in this country. Conductors on street cars are paid 93 cents per day for the first year, and $1.04 the third year, while conductors on street cars in New York are paid $2.00 the first year and $2.25 after that. The average wages for the railroad men in Glasgow are 78 cents per day, while in New York they are $1.88. Here we have a difference of more than 100 per cent. in wages alone.

"Anyone who has travelled over the street railroads in Glasgow knows perfectly well that the whole equipment and accommodations are antiquated and behind the day, while the service furnished there would not be tolerated in any city in the United States. We are also told that the profits or revenue from the street railway in Glasgow, is so large that it pays all the expenses of the government, while in fact the roads are not operated for the purpose of producing a revenue to meet current expenses of the municipality. Instead of there being no taxes in Glasgow, they are more burdensome than in this country. Rents are taxed 12 1-2 cents on every dollar that man pays, and the owner of the property has to pay the same amount of tax. Besides this, license taxes are levied. You pay a tax for every servant you employ in the house, also on every horse or carriage; in fact, you cannot turn round without running against the tax collector."

What would become of electric light, telephone, street railway and gas plants, if these undertakings were in the hands of municipal authorities? Would improvements in these enterprises be encouraged or would they remain at a standstill? The whole question seems to me too simple for elaborate discussion. A Municipality should not be allowed to tax its citizens for its own bnefit, but for the benefit of the whole and not of the few. Administration of justice, the protection of life and property, the police and fire departments, and civic affairs generally, such as the maintenance of roads and sanitary conditions, are things in which all the citizens are interested, and for which all should be called upon to bear their proportionate share of cost. We might go as far as to include water, as this commodity is needed by every person, rich as well as poor, for fire protection and sanitary purposes. It comes therefore fitly under municipal control, and at this stage I might say that if a private company were furnishing the water that is being furnished to-day to the City of Montreal, the citizens would rise up in arms. Would they accept unfiltered St. Lawrence or Ottawa River water for domestic use, receiving as it does the drainage of the towns between Toronto or Ottawa and Montreal, and at a price fully twice as high as it would be, were it under private control? My answer is, No.

The water works plant is undoubtedly operating at a considerable profit, and the city as a whole it is hoped is benefiting financially. On the contrary, were we to take the case of gas or electric light, if it is operated at a profit, then the users of the light are paying that profit. If it is run at a loss, then the municipality is carrying on a business which is not profitable, to the detriment of the taxpayers who are not using light.

That there are many honest supporters of municipal ownership who have been deceived by the highly-colored, but false reports from cities that are experimenting with this question, is undeniable. It is only natural to suppose that municipalities after having made large investments in municipal enterprises should endeavor to justify what they have done. They certainly will be reluctant in throwing the limelight on their errors in acts and conclusions. On the contrary, the tendency will be to suppress the bad and give prominence to the good, which is only to be expected, and this important question really gets serious consideration from owners of property only when the situation becomes acute or puts the taxpayers on the defensive.

The following analogy is taken from "Municipal Ownership":—

"Aesop's fable of the fox and his lost tail, here finds excellent application. The wily old fellow wished company in his misery, and, we recall, urged all the other foxes to cut off their tails. He gave as many favorable reasons as a proud possessor of a municipal plant can offer a sister municipality in urging her to do likewise.

But the assembled foxes remembered that the loss of a tail is easily accomplished; that the troublesome thing is to get it back again. Municipal, like private, funds may be spent at any time—they take flight easily—with less ease one again gets possession of them."

Governments, federal, provincial, or civic, are instituted for the purpose of protection, not production. It would be just as reasonable for either of these bodies to enter any pursuit, such as bakers, grocers, saloon keepers, or the insurance business, as it is for them to enter the field of public utilities, and

"Just so sure as a nation becomes a commercial producer, competing against its own citizens, just so sure will the seeds of its own disintegration be shown. There is no finality to municipal enterprise."

The character of a public service is to be judged as much by the extent of the service as by its cost. In other words, it is better to serve double the area and number of inhabitants at a given cost, than it is to serve one-half that number at half cost.

Recent public reports of Glasgow, Edinburg, Manchester, Leeds and Birmingham, show that they are operating a smaller number of lamps than Chicago alone, and very few more than Boston, while the combined population is a million more than Chicago, and fully five times that of Boston. If you take Glasgow, Hull, Brighton, Portsmouth and Swansea, you will find that on December 31st, 1905, the number of municipal telephones was less than 20,000, while the number of private telephones was over 40,000. In 1905 the increase in municipally-operated telephones was 12.05 per cent., and the private telephones 92 per cent.

EXCLUSIVE FRANCHISES.

Exclusive franchises are not popular, but the best service at the lowest cost can only be secured in gas, electricity, telephones, or street railways, by one company having exclusive control within given limits. But in such cases, in order to protect the public, exclusive franchises should only be given under some sort of public control.

Mr. Allen R. Foote, commissioner of the Ohio Board of Commerce, is quoted as follows:—

"You want the best obtainable service at the lowest profitable price. It goes without saying that you cannot get that condition by dividing your demand between two or more corporations. The economies of production and distribution are not increased by division, but by concentration. Therefore, the problem properly analyzed does not admit of competition as a factor.

"In the past record of this country, the whole effort has been to regulate public service utilities by competition, and all the complaints that are now being pressed, of discrimination in rates, and rebates, secrecy of accounting and over-capitalization, are the direct and legitimate results of attempting to regulate a business that is a natural monopoly by the principles of competition. Assuming the point of view that a business is a natural monopoly, then, it must be controlled and regulated by principles to control monopolies. That means public regulation."

During the past year the City of Syracuse appointed a special commission to inquire into the lighting question, and their report was handed in on the 3rd of September last. The findings of the committee are adverse to a municipal plant either for gas or electricity, and the following is quoted from their report, which is now a public document:—

"The granting of a franchise which results in competition in electric lighting and power service is fraught with many grave contingencies. The inconvenience and annoyance to the public in having duplicate systems of poles and wires in the streets is sufficiently obvious, and it is not necessary to enlarge upon that feature of such a situation. Only most urgent necessity for relief from unsatisfactory services and excessive rates, and the failure of other practicable remedies, would warrant such a step.

"Duplication of electrical distributing systems increases the number of poles and wires in and over our streets, with consequent greater difficulty in contending with fires. The responsibility from accidents from crossed wires and defective construction is not so readily and certainly fixed when numerous independent systems of wires are in the streets.

"The division of the business between competing companies makes it less practicable to compel the use of underground conduits extensively, because competition renders the business less profitable to both companies, or if separate conduits are constructed, the disturbances of the surface of the street become a more serious annoyance to the public.

"As against the possibility that the public might receive, at least for a time, better rates and service, is the other possibility (not to say probability) of an agreement being arranged between the nominally competing companies, which would nullify the effect aimed at through competition. If we may draw deductions from practically all previous experience with such utility corporations, we may conclude that the outcome—should the Niagara Distributing Company actually have entered the local field—would probably have been either an agreement with the Syracuse Lighting Company to divide the business along territorial or other lines, or else a consolidation of the two corporations on some basis to their advantage, rather than to the advantage of the public.

"The division of the business would probably not enhance the grade of service to individual users, nor reduce the rates for power or light. On the other hand, it would naturally have the opposite effect.

"Merging of two companies would result in a larger capitalization on which the consolidated company would endeavor to pay interest or dividends. It would also naturally desire to recoup itself for reduced returns during the period of competition. We may conclude, therefore, that competition in itself is not to be desired in the electric lighting and power field."

Compensation for Franchises.

You may have noticed in connection with public utility franchises that certain civic rulers, and I may say the Press, have publicly demanded from the companies certain percentages on their gross earnings, to be applied to the making of good roads, etc. Now, if the price for service is based on cost, it matters little to the companies whether they pay the percentage demanded direct to the municipality or not. If the public demand it why cannot the companies pay it, as it would simply be an added expense to cost? If they do not demand it, then the cost, and consequently the selling price, would be so much less. It then becomes a question whether the company is to be a public taxgather for the municipality, or whether the municipality should collect direct from the citizens, which to my mind is the only fair way, otherwise you compel a small minority of the citizens using the commodity in question to unfairly contribute to the city's revenue, while the benefits would be reaped by all.

Remedies.

Having reviewed the origin of the agitation for municipal ownership of public utilities, I will endeavor to point out my idea as to the proper remedies, and I would say right here that the remedy does not lie with the companies alone. It lies with the company, the consumer, and the public. There must be some give-and-take from the company, the authorities, and the public, or nothing effective will result. Public companies for their own salvation must endeavor to give the best service at the lowest cost. In my opinion the best results will be obtained by a system of public control. A "Public Service Commission," framed on the lines of the existing Railway Commission at Ottawa, would go a long way to protect the interests of both the company and the user. Reasonable inflation of capital is necessary to offset the possible loss or questionable profit. Fair treatment for capital invested in corporate enterprises is imperative. Capital is answerable to public opinion, which is oft-times unreasonable and must be led, not disregarded. Rather educate the people in the fact that public corporations should have the same protection in the enjoyment of the rights to their property as is enjoyed by other investors.

Massachusetts, U. S., has had a form of public control of private companies for the past 13 years that appears to have given fairly good satisfaction. No doubt it also has its imperfections, and at times we hear of corporations and the public not being satisfied with its application in specific cases. On the whole, however, it has been advantageous. The consumers are better and more cheaply served, and employed capital is better protected. Stock watering has been eliminated and reasonable returns on capital allowed. Badly-framed or viciously-applied laws could do serious damage, but with a real desire on the side of all parties to secure a justice for all alike, public control offers a far better solution of all difficulties than does municipal ownership.

As I have stated, public companies must endeavor to give the best service at fair rates, and the most satisfactory results will be obtained by following the lines laid down by the "London Sliding Scale," thus making the consumer a partner in the enterprise by reducing the price as rapidly as is consistent with sound management, and by treating the public as though they were its servants, not its masters. In all intercourse with the consumer or public, be it through the highest official of the company or its office boy, it should be the aim of the company to establish good feeling with the customer, even at the sacrifice of personal dignity. When the public appreciate that they are being fairly treated by corporations they will not object to fair returns on the capital invested.

So far as I can judge, the consensus of opinion of writers on this subject seems to be that some form of public supervision and control of charges for service by quasi-public corporations, offers the only solution of the problem.

"It preserves individual initiative, does not discourage enterprise nor the combination of private capital. It leaves industrial freedom unharmed, simply controls it in the public interest, enforces the rights of the consumers, while protecting the rights of industrial liberty."

Electrical Contractors.

The annual meeting of the Electrical Contractors' Association (which is the electrical section of the Builders' Exchange) was held last month, and resulted in the election of the following executive officers for the current year: Mr. F. J. Parsons, president, elected by acclamation (representing the firm of McDonald & Wilson), Mr. N. Simoneau, elected unanimously as representative director to the board of the Builders' Exchange; Secretary, J. Herbert Lauer; Executive Committee, Messrs. Brock (of Collyer & Brock), Philip Lahee, J. D. Lachapelle (Eastern Electrical Engineering Company), D. McQuaid (Century Electric Company), J. E. Scott (Scott & Rubinstein), W. B. Shaw (Montreal Electric Company), J. A. Valois (Chambly Electric Company).

Publications.

Circular No. 1104, issued by the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., deals with the Portable and Precision Meters manufactured by that firm. It consists of some 54 pages and is a handy reference volume for users of meters.

From the Weston Electrical Instrument Company we have received a pamphlet describing their new portable alternating current instruments. These comprise fourteen different ranges of portable alternating current ammeters, five different ranges of portable alternating current milammeters and seven different ranges of portable alternating current voltmeters.

Bulletin No. 102, issued by the John McDougall Caledonian Iron Works of Montreal, describes that firm's Worthington Multi-Stage Turbine Pumps. On the front cover of the bulletin appears a photograph of their three-stage 14-inch pump, driven by a 400 horse-power induction motor in operation at the McTavish street station of the Montreal waterworks. Various styles and sizes of pumps are described, and information given regarding their modus operandi.

As a means of increasing the efficiency of plug and pin bonds the Chase-Shawmut Company of Newburyport, Mass, present the "Shawmut Auxiliary Bond"—a copper cap with rail engaging flange filled with solder, heated and applied to end of bond, and which by giving additional contact surface reduces to a minimum the resistance at the rail joint. A recent test made with "Auxiliary Bonds," applied on new plug bonds just installed, showed that an improvement of over 15 per cent. in conductivity resulted. With a bond 15 per cent. better than a new plug bond, and having the advantage of a permanent metallic union, as contrasted with an uncertain pressure contact, the Chase-Shawmut Company believes that all railroad men will appreciate this means towards cost reduction.

The Chase-Shawmut Company have also placed upon the market the "Shawmut Rail Bond Protector," a device designed to protect both the soldered and plug type of bond from being sheared off by wagon wheels, damaged by paving stones or ballast, injured by track crews and to discourage theft. This protector is made of heavy steel securely fastened to rail by means of bolts which hold fishplate in place, thus making application of the simplest nature. It is of such shape as to allow inspection of bond without removal of fishplates, and can be applied to either new or old rails at a minimum cost without impeding traffic.

Electric Headlights on Locomotives.

The Railway Commission is sending out a circular to the different railways stating that it has in view an order for electric headlights on locomotives, and inquiring as to what representations the companies have to make previous to the order being made effective.

Meeting Toronto Section American Institute of Electrical Engineers.

On the 20th ult., after a luncheon at the St. Charles, at which some twenty-five members of the Section and their friends were present, the Toronto Section of the American Institute of Electrical Engineers held their regular February meeting at the rooms of the Engineers' Club, 96 King street west, in conjunction with the club, many of whose members were present. Over fifty in all attended.

After the formal business of the evening, the chief item of which was the presentation and carrying of a motion requesting the board of directors to take up the matter of the subdivision of the Associate group of the membership, the technical subject for the evening was taken up. This involved a paper presented by Mr. Walter S. Moody, of the Schenectady Section, who very thoroughly treated the subject in hand, namely, "Feeder Regulators." Mr. Moody, who is a chief designing engineer with the General Electric Company of Schenectady, took up the history of the attempt to regulate the voltage of feeders in distributing and transmitting systems. He indicated the lines of development of this apparatus from the earlier resistance methods of control in the case of direct current circuits to the most recent outputs of the electrical manufactories, the automatic induction type of alternating current regulator. He then discussed at considerable length the latter type of regulator, showing its field of operation, its mechanical characteristics, and indicating some of the successful installations with records of their performance. The address was very fully illustrated by means of lantern slides, and at its close a number of inquiries were made of Mr. Moody, concerning the features which he had touched upon, and a considerable discussion followed.

The thanks of the Toronto Section is due to the Engineers' Club for courteously postponing the subject which they had proposed to discuss, and accepting an invitation to join with the Section in a reception to Mr. Moody. A vote of thanks was proposed to Mr. Moody by Messrs. F. F. H. Wyse and H. F. Strickland, and was most heartily supported by those present.

Engineers' Club Building.

A club house and office building for the engineers and architects of Toronto is being planned, and efforts are being made to secure a guarantee of $500,000.

The building, it is said, will be large enough to accommodate several hundred members of both professions—a regular arts and crafts centre. The Engineers' Club and the Architects' Associations are interesting themselves in the proposition.

Besides offices for the members, it is proposed to rent a large number to others outside. Full arrangements would also be made for fully equipped cuisine.

Damming the St. Lawrence.

There was discussion in the Dominion House on February 12th last, regarding the proposal of the Long Sault Development Company to dam the St. Lawrence River, near Cornwall. The subject was introduced by Mr. Honore Gervais, and statements were made by Sir Wilfrid Laurier and Hon. G. P. Graham, minister of Railways and Canals. Mr. Gervais moved for a copy of all correspondence, papers, writings, plans and letters between the Government and the International Waterways Commission and the St. Lawrence Power Company and Long Sault Development Company. In support of his motion he claimed it was nothing short of an outrage to permit the obstruction of the St. Lawrence.

Hon. G. P. Graham admitted the proposition to dam the St. Lawrence would come as a shock to every Canadian. Tourists from all parts of the world had gloried in the beauties of the river between Kingston and Montreal, and any attempt to take away that beauty in any degreee was bound to be resented. Touching on the scheme as it is proposed to work it out, that is to dam the river and make a little river on the south side of the channel of navigation, Mr. Graham doubted whether this could be done without jeopardizing property on the Canadian side by floods. Before the Government considered the project they would have to be set entirely at rest regarding this property question, to say nothing of the question of the navigation interests. Mr. Graham understood that the United States Government favored the project.

Mr. Borden asked whether the Government had any statutory power to make any arrangements, and Mr. Graham replied that he was under the impression the company would have to come to Ottawa to get a charter.

Mr. Graham admitted that he had received many resolutions of protest against the proposed undertaking from those interested in the carrying and tourist trade, and from those living along the river, whose property might be affected.

Mr. R. L. Borden urged the Government to consider that no water power, which belonged to the people of Canada should be parted with without the consent of the people through their representatives. Before any steps were taken the proposal must be submitted to Parliament. The exploitation of such great national resources as the Long Sault Rapids, shoulld be conducted in such a way as to be of the utmost advantage to the people.

Sir Wilfrid Laurier said the matter had been some time before the Government, and no steps whatever had been taken except to hand over the petitions to the Waterways Commission, who were considering the subject. The Premier admitted he knew that all the influential bodies of Montreal were absolutely averse to the scheme, and that seemed to be the general opinion throughout Canada. Sir Wilfrid assured the House that the Government would not agree to any proposition without the fullest consideration of the same in Parliament.

Mr. Gervais secured an order for the papers and the subject then dropped.

Develop 14,000 Horse-Power.

A Cobourg deputation which recently interviewed Hon. Geo. P. Graham, Minister of Railways, at Ottawa, in support of their petition for a lease of the intervening portion of upper Healy Rapids, was composed of municipal officers and prominent citizens of eighteen municipalities, and business men from eight ridings. It included Manager Culverwell, of the Northumberland-Durham Power Company, Port Hope; E. C. S. Huycke, K.C., Cobourg; H. T. Bush, president of the Standard Ideal Company, and R. A. Mulholland, Port Hope.

The Northumberland-Durham Power Company has been granted a lease by the Ontario Government of lower Healy Falls, both sides, and lower adjoining rapids, and also a patent of 56 acres of land necessary for development of the works. The company also own by deed two portions of the upper Healy Rapids and land adjoining.

The company have agreed not to restrict the use of the power to the counties of Northumberland and Durham, as was at first noted, but will construct an electric line to Havelock and Norwood at the same time that it builds its main line to the lake front.

One hundred thousand cubic feet of water flow over Healy Falls every minute, or enough to develop 14,000 horse-power at the driest time of the year. If the request is not granted there will be some 7,000 horse-power developed.

Behind Healy Falls is a reservoir of fourteen miles of river, from 100 yards to a quarter of a mile wide. The company propose in return for the privilege they are asking of the Government to give land for locks and canal cuttings, and also water for lockages.

Queen City Motor and Dynamo Company.

The Queen City Motor & Dynamo Company, whose plant is at 20 Pearl St. this city, announce that they have acquired a large and splendidly equipped plant of up-to-date machinery, in charge of expert electricians and machinists, and are prepared to furnish estimates for any kind of new or repair work connected with dynamos, motors and generators and all kinds of machine repairs.

Canadian Crocker-Wheeler Company.

Another promising sign of returning confidence in the business situation is the organization of the Canadian Crocker-Wheeler Company, Limited, for the manufacture and sale in Canada of the well and favorably-known Crocker-Wheeler apparatus.

The latter company manufacture practically all types of direct current and alternating current motors and generators, power transformers, motor generator sets, frequency changers, etc. Some of their best known lines are: Direct current motors for special purposes, such as machine, tool and printing press drive, and steel mill work. For the latter, a line of motors has been specially developed, which has been found to fully meet the very severe conditions which exist in steel mills. Crocker-Wheeler alternating current generators up to 2,000 kw. capacity have been in successful operation in Canada for some years. The officers of the company are as follows: Fritz E. Lovell, president; R. A. Stinson, vice-president; F. Jno. Bell, secretary-treasurer.

The head office is located in the Street Railway Chambers, Place d'Armes Hill, Montreal.

Electric vs. Steam Railways.

Interurban electric railways flourish in competition with steam railroads, not so much, it is said, because rates of fares are slightly lower, but because the service is more attractive to the traveling public for short trips—that is, up to, say 100 miles. One great advantage is the absence of smoke and cinders, making the journey pleasanter; another is more frequent trains, tending to convenience of passengers; a third element in favor of the electric railway is that usually city terminals are so arranged that passengers can board the car nearer their homes and ride closer to their destination than is the case on steam railroads. The tendency and demand of the day are for frequent, rapid service—rapid at frequent intervals rather than one or two very fast trains and a sparse, slow service. The immediate problem of the steam road, as is pointed out by an officer of one of the trunk-line steam railroads, is to provide such service at low cost, else the older railroad must be content to see the business taken by aggressive competitors, who also contemplate attracting the freight traffic. The apparent solution is electrification of existing steam lines for passenger service.

LE MANQUAIS

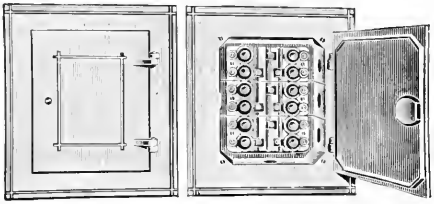
SECTIONAL IRON PANEL AND CUT-OUT CABINETS

(Manufactured Under Canada Patent No. 92393.)

THEY MEET ALL UNDERWRITERS' AND INSPECTORS' REQUIREMENTS.

Wooden doors and trims shrink, swell, crack and warp. Therefore, cut them out and use all metal instead.

Cut out that argument about bonding your conduits. Use our ALL iron Cabinets and the bond is perfect.



Style A—6-Circuit Iron Cabinet.

Did you ever get a cabinet installed and have to rip all your work out again on account of a couple of additional circuits desired?

This can be avoided by using our Cabinets. They can be built up or down to any size desired.

THEY COST NO MORE MONEY THAN SLATE-LINED CABINETS, AND CAN BE INSTALLED IN HALF THE TIME.

Accessible for Inspection or Renewal Without Removing Door and Frame.

Use Nothing but Iron on an Iron Conduit Job and Satisfaction is Certain.

THE R. E. T. PRINGLE CO., LIMITED, MONTREAL, QUE. WINNIPEG, MAN.

CANADIAN INVENTION
CANADIAN ENTERPRISE
CANADIAN CAPITAL

CANADIAN
INDEPENDENT
TELEPHONES

Canada invented the Telephone.

Canadians invented

CENTRAL ENERGY AUTOMATIC TELEPHONY

We are building up a new Canadian industry, manufacturing and operating Telephones and Telephone Supplies in Canada in opposition to the Telephone Trust.

We have a FULL LINE

Magneto-Central Energy Manuel-Lorimer Automatic

We are prepared to engineer, equip and instal complete telephone systems.

WRITE FOR PARTICULARS

Canadian Independent Telephone Company, Limited

26 Duncan Street, TORONTO, Ont.

Mar.

Sparks.

The contract for the lighting and wiring of the city hall at Guelph has been let to Stevenson & Malcolm.

R. H. Jupp, of Orillia, Ont., has been appointed county engineer of Simcoe at a salary of $1,000 per annum.

The wiring contract for the Carnegie Library at Oshawa, Ont., has been let to Alexander Miller of that town.

Engineer Sothman, of Hamilton, Ont., has been appointed by that city to draw up specifications for a municipal lighting and power plant.

Five hundred and ninety-nine miles of telephone lines were put into operation in Alberta during the year 1907, and eighteen exchanges placed in commission.

A report from Creston, B.C., states that a project is on foot to develop power at the Goat River canyon and that company is now in process of organization.

At a recent meeting of the special power committee, Toronto, a recommendation was passed calling for the appointment of an engineer to make an estimate on the cost of installing a plant.

Henry D. Symmes, of Niagara Falls, Ont., has been granted a natural gas franchise by the city of Windsor, Ont. It is stipulated that 20 miles of pipe must be laid by February 1st, 1909.

C. A. Holden, late assistant engineer in the power construction department of Winnipeg, has been appointed superintendent of the city power plant and lighting system at Moose Jaw, Sask, vice A. C. Read, resigned.

George Janin, superintendent of the waterworks, Montreal, is taking tenders up to March 24 for the supply and erection of a 12,000,000 gallon pump for the low level pumping station. Address bids to L. O. David, City Clerk.

A 2,500,000 gallon turbine pump with electric motor is required for the Winnipeg city waterworks, and M. Peterson, secretary of the Board of Control, will receive tenders for supply of same up to March 24. Specifications may be obtained at the office of H. N. Ruttan, city engineer.

It is understood that an amalgamation has been effected by the Robertson Machinery Company, Welland, Ont., and an American firm, who will merge their Canadian interests with the Welland company.

Recent developments indicate that a contract for Niagara power will likely be made by St. Thomas, Ont., with the Hydro-Electric Commission, in which case $35,000 will be raised by debentures for the erection of a distributing plant.

G. Archibald, superintendent of the Water and Light Committee, Woodstock, Ont., is authority for the information that the city will purchase new pumps and extend the power lines at an estimated cost of $27,000.

Sparks.

The Standard Foundry Company, of Longueul, Que., have dissolved.

An independent lighting and power plant will possibly be installed at McGill University, Montreal.

The Georgian Bay Power Company will build a dam and power house this season in connection with the water power development for transmission from Eugenia to Owen Sound. A quantity of fifty-four inch steel pipe will be required in the undertaking. H. von Schon, of Detroit, Mich., is the consulting engineer.

Engineer Monds has completed the survey for the proposed power development at Dog Lake Falls, undertaken at the instruction of Cecil B. Smith, Toronto. The transmission line will be nearly twenty-five miles long.

A gas producer plant is to be installed at the pumping station at Deseronto, Ont., and a special committee have been appointed to secure figures on the cost. A 100 horse-power engine will be required.

The contract for the erection of the new power house at Campbellford, Ont., in connection with the Middle Falls power project, has been let to Bogue & Buchanan, of Peterborough. The dam is to be constructed by Brown & Aylmer.

It is now regarded as certain that the erection of the proposed new locomotive works at Lachine, Que., will be commenced this spring. The project was formed by the Trust & Loan Company, of Montreal, and is backed by the Beyer-Peacock Company, of London, Eng. Sir Vincent Caillard, president of the former concern, and chairman of the latter, is stated to be at the head of the new undertaking and is reported to have secured a sum of $60,000 for the purchase of a site near this city.

F. C. Whatmough, electrical contractor, Stratford, Ont., has been awarded the contract for a complete electrical equipment at St. Jeromes' College, Berlin, Ont.

Hon. Mr. Cushing, Minister of Public Works for Alberta, in a recent speech said that it was the purpose of the Government to prosecute its telephone construction until the province should be covered with a network of lines from north to south and east to west, extending even as far to the north as Athabasca Landing. At the present time 544 miles of long distance lines are equipped with copper wire, and 53 miles of rural lines constructed of steel wire on a cheaper plan. There has been invested in the system up to the end of the past year $284,244. It is now proposed to expend on new construction work during the coming year a further sum of from $350,000 to $400,000, and the Government's plan for financing this is to borrow on debentures. If, in the meantime, anything more definite comes out of the attempted deal with the Bell people, a very much larger investment will, of course, be necessary.

New Canadian Supply Factory.

An important addition to the Canadian factories producing electrical supplies is that of Electrical Specialties, Limited, whose premises on Shuter street, Toronto, are well equipped for their purposes. They have undertaken the manufacture of "X Cells" dry batteries. The hight duty on the imported article makes it probable that they will find a good Canadian field. The manager of the company, Mr. Alfred Landau, has been manufacturing batteries for many years and is well known in the electrical world.

The class of batteries now being made in the Toronto factory have been manufactured in Chicago with great success. "Our batteries," said Mr. Landau, "are not an experiment, but the result of many years of investigation and study by leading ignition and telephone engineers." Mr. Landau stated further that the company have plenty of capital to carry on a large business, and will guarantee the material and workmanship of their batteries. A material advantage that they will possess as Canadian manufacturers is the fact of having to pay duty only once. American manufacturers import their raw material from Europe, paying an import duty, while the Canadian buyer of American batteries has still another duty to pay.

MOONLIGHT SCHEDULE FOR MAY.

Date.	Light.	Date.	Extinguish.	No. of Hours
May 1	7 20	May 2	4 20	9 00
2	7 20	3	4 20	9 00
3	7 20	4	4 10	8 50
4	7 20	5	4 10	8 50
5	10 30	6	4 10	5 40
6	11 10	7	4 10	5 00
7	11 50	8	4 10	4 20
9	0 20	9	4 10	3 50
10	0 50	10	4 10	3 20
11	1 20	11	4 10	2 50
12	1 40	12	4 10	2 30
13	2 10	13	4 10	2 00
14	No Light	14	No Light	
15	" "	15	" "	
16	" "	16	" "	
17	7 40	17	10 30	2 50
18	7 40	18	11 40	4 00
19	7 40	19	0 40	5 00
20	7 40	21	1 30	5 50
21	7 40	22	2 10	6 30
22	7 40	23	2 50	7 10
23	7 40	24	3 20	7 40
24	7 40	25	3 50	8 10
25	7 40	26	3 50	8 10
26	7 50	27	3 50	8 00
27	7 50	28	3 50	8 00
28	7 50	29	3 50	8 00
29	7 50	30	3 50	8 00
30	7 50	31	3 50	8 00
31	7 50	Jun. 1	3 50	8 00
		Total	....	168 30

CANADIAN
ELECTRICAL NEWS
& ENGINEERING JOURNAL

PUBLISHED ON THE FIFTH OF EVERY MONTH BY
HUGH C. MacLEAN, LIMITED,
TORONTO, CANADA.

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362

MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative

WINNIPEG - - - - - - - Telephone 224. 330 Smith St.
ROLAND F. HILL, Representative

VANCOUVER - - - Telephone 2248. 615 Hastings St.
GEO. A. GALL, Representative

ADVERTISEMENTS.

Advertising rates sent promptly on application Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.

The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

Lighting Progress. The electric art is making wonderful progress in many and varied directions; in the rapid evolution in heating devices, for instance, on one hand, and the enormous growth of alternating current traction on the other. But in all probability the present researches into lighting devices of higher efficiency will result in wonderful strides being shown by that branch of the art within a comparatively short time. It is only two to three years ago that experiments on the new forms of incandescent lamps began to bear fruit, yet to-day tantalum and metallized carbon filaments are almost commonplace, while the tungsten lamp is rapidly becoming a commercial article. The Nernst, too, has been further developed, in that a series street system has been perfected, while in arc lamps the flaming and luminous forms have appeared on the market, to say nothing of the various developments of the vapor lamp, such as the Cooper-Hewitt, Moore tube, and the Quartz lamp.

The magnetite or luminous arc gets its name of magnetite from the fact that magnetite, an oxide of iron, forms one of the main constituents of the negative electrode, the term luminous coming from the fact that the greater part of the light comes from the arc itself more than from the electrodes, which latter emit most of the light given by an ordinary carbon arc. The flaming arcs also give most of their light from the arc itself, but this term is applied, as a rule, only to those lamps which use impregnated carbons for the electrodes. Metallic salts of various kinds are used for this purpose, the result of the combination being highly increased efficiency. The color of the light varies with the different ingredients, yellow, red and white being the most usual. The first, which is produced by certain calcium compounds, is the strongest for a given energy expenditure, in other words, the yellow carbons are the most efficient. The next best are the red, the white giving relatively the least light of all. It is noteworthy that while the luminous arc has been developed with an electrode life fully equal to that of ordinary carbons, the impregnation of those used in flaming arcs, combined with the fact that they burn in practically open air, has resulted in a very short life for this form, namely, eight to fifteen or sixteen hours. Efforts have been made to increase this by the magazine form of lamp, but this design has not proved very popular. Besides having this short life, all flaming arcs give off vapors which are more or less disagreeable and attack brass and copper, in consequence of which they have not proved very popular for anything outside of advertisements, and the lighting of large interiors, such as railway stations, markets, drill halls, etc. They give a fairly good distribution, particularly with opal globes of fair density, though the tendency is naturally to throw a good deal of the light downward.

The vapor lamps represent the development of an entirely different principle, and one that has for some time been recognized as the most efficient means for the transformation of electrical into light energy, namely, electric conduction through rarefied gases or vapors. Perhaps the best known of these is the Cooper-Hewitt, which is a design adapted for either A.C. or D.C. current. Another form that has been used to a certain extent is that known as the Moore vacuum tube, built for A.C. circuits only. Besides these there is the Quartz lamp, developed in Germany, the present designs being D.C. only. These three forms all use mercury vapor in an exhausted tube as the conducting medium. This design, in common with the mercury rectifier, needs some auxiliary method of starting, as, until an arc is started, the resistance from pole to pole is so high as to prevent the normal voltage producing any current flow. The Cooper-Hewitt and the Quartz forms accomplish the desired end by tipping the tube so as to make the mercury run across from one terminal to the other, while Mr. Moore uses a high voltage shock to break down the initial resistance. The tubes of the Cooper-Hewitt and Moore types are both of glass, the former some two or three feet in length for each lamp, while the latter is made to extend, by adding one tube to another, the units being some six feet long, right round the room to be lit. A single lamp may thus have a light producing element which is twenty or thirty feet long, if not considerably more. The tube in the Quartz form is about six inches long, and is made of quartz, not glass, hence the name. The object in using this material is to

get the benefit of its very high melting point, with a consequently increased efficiency, as the mercury vapor can thus be run at a much higher temperature than if it were contained in glass. Besides this, it is claimed for this design that the light is much whiter than that of other mercury lamps.

The final development of these various types will be watched with great interest, as undoubtedly the next few years will witness many radical changes in arc as well as in incandescent lighting, in fact it now looks as if the day of the old and faithful carbon filament and electrode were well-nigh over.

The Evasion of the Code.

As we pointed out in last month's issue, there is still a tremendous amount of work done which is not in accordance with the National Code requirements; work in fact which not only violates the actual letter of the law, which is bad enough, but which is directly contrary to its spirit. This is, of course, exceedingly bad for everyone in any way connected with electrical undertakings, as well as for the actual customer himself, because such violations are sure to cause trouble sooner or later. This trouble may come in the shape of a death from electric shock, it may come as a serious fire, or it may show itself in the milder form of interruptions to the service, but come it certainly will, if we do not obey the laws set down for our best and proper guidance. This is so obviously true that no one now really questions seriously the great necessity for installing all wiring in strict accordance with every Code requirement.

This then being true, what is going to be done about that great number of installations which, put in years ago, have never been touched from that day to this. We are all aware that in a large percentage of them even a cursory inspection would reveal fault after fault of the most glaring character. This is a phase of the question which demands most serious and immediate attention, unless we are content to harbor a grave menace without making any effort to get rid of it. "The fire, it is thought, was probably due to defective electric wiring" is becoming such a stereotyped expression in the daily press that it is now more or less recognized as a convenient way of saying that they don't know what caused it. Still, if some of the worse conditions that now exist in old work are not soon eliminated, there is great danger that the expression will become true to an alarming extent. Probably the most flagrant violation of the Code is in the continued use of old open link fuse blocks, the majority of which to-day have not even the mica or porcelain covers with which they were originally equipped. For instance, last week we saw, in passing through one of the best known hotels in Ontario, a large uncovered link fuse block in the ceiling of one of the halls, and directly over a carpet. Greater possibilities for starting a fire are scarcely to be found in the electric art, and a fire once started in that particular building would in all probability leave absolutely nothing but a heap of ashes, as it is entirely wood from top to bottom. Then again, take the way in which wires are led through partitions, and even through metal ceilings, without tubes or any other protection. Without any question the Underwriters have a serious situation to face in this matter; in fact if they do not do something, while continuing their very strict and eminently proper supervision over all new work, they lay themselves open to the charge of straining at a gnat while swallowing a camel. Further, the situation is also up to the electric light company, in that without action on their part the Underwriters are materially handicapped. Let every manager, therefore, who values the reputation of electric light and power, take the necessary steps to co-operate with the Underwriters in an effort to get all old work gone over and brought, in the main points at least, up to date. The Canadian Underwriters have done good work, and doubtless propose to improve as opportunity presents itself, but they need co-operation, particularly in this most important matter.

Ontario Government's Power Plans.

Mr. P. W. Sothman, chief engineer of the Ontario Hydro-Electric Power Commission, will leave early this month for a trip to California, Mexico, Colorado, Michigan and other localities in the south to investigate the existing high power transmission lines in use. It is expected that the outcome of the present situation in the Ontario power matter will be the erection by the Government Commission of its own transmission line. This course has not yet been definitely decided upon, but it hangs at present in the balance, with strong indications in the direction mentioned. If this becomes the case, the information obtained by Mr. Sothman on his trip will be extremely useful. There are now transmission lines carrying 100,000 horse-power in the States and some higher still, and in order to adopt the most up-to-date methods, comparisons of these will be necessary. Mr. Sothman expects to occupy a fortnight on the trip, and on his return to be in a position to decide upon the most important details, in case the Government orders the erection of its own transmission line.

Requests for power from the Commission have come in from the following municipalities: Toronto, 10,000 h.p.; London, 5,000 h.p.; Galt, 1,200 h.p.; Guelph, 2,500 h.p.; Hamilton, 1,500 h.p.; Berlin, 1,500 h.p.; New Hamburg, 250 h.p.; Woodstock, 1,200 h.p.; St. Thomas, 1,500 h.p.; Waterloo, 685 h.p.; Brantford, 1,500 h.p.; Stratford, 1,500 h.p.; St. Mary's, 1,500 h.p.; Preston, 600 h.p.; Hespeler, 400 h.p.; a total of 30,835 h.p.;

A new railway company to be called the Great American Railway has filed articles of incorporation. It is to run between Chicago and Winnipeg.

Alberta Buys Out the Bell Company.

The purchase of the Bell Telephone Company's plant in Alberta by the Provincial Government is reported to have been completely arranged. Hon. W. H. Cushing, Minister of Public Works for Alberta, was in Montreal during the last week in March completing the necessary negotiations with the company there. The purchase price which the company asked was $750,000, but Hon. Mr. Cushing thought this was too much and held out for a lower price, which, it is reported, was accepted by President Sise of the Bell Telephone Company. The figure reported to have been agreed upon is $675,000.

Since its erection into a Province, Alberta, has been constructing its own telephone system, and this is already as large as the one which it has now purchased from the Bell Company. The province will now be in a good position to carry on extensive operations. Hon. Mr. Cushing has stated that the province intends to increase its system as occasion warrants and to run the telephone department so economically that there will be no inducement for any private company to try to enter the field. He further has stated that there is a strong feeling throughout the West in favor of public ownership of telephones, and has expressed a conviction that the Government of Saskatchewan, which has already done a good deal of telephone building, will soon follow the example set by Manitoba and Alberta.

Cancel Niagara Power Company.

The annual report of the Niagara Falls Park Commission has been presented to the Ontario Legislature. The report deals with the improvements which have been made during the past year and goes on to discuss the charters which have been granted by the Dominion Parliament to several corporations for generating power in the Niagara district. Impressed with the vital importance of this subject, the Commissioners draw attention to the fact that these charters have not up to the present time been proceeded with. Continuing it says: "Without question the works already constructed by the three companies operating on the Canadian side are of sufficient capacity to supply the demand for electricity for lighting and power purposes, for Canadian users, for a great many years to come. As the undeveloped charters are all without limitation as to the volume of power which may be developed, and without restrictions as to the quantity of water which may be taken for such developments, it is essential to the safeguarding of the Falls that immediate steps should be taken to cancel them, or to place a limit on their operations, so that the menace they now present to the preservation of the Falls as a great natural wonder may be removed. In this connection the commissioners would strongly recommend that the Government of the Province of Ontario, being chiefly interested, should be officially represented at any international conference that may be held, having in view the uses of the waters of Niagara for commercial purposes or for the limitation of such uses in furtherance of the preservation of the Falls."

The report also refers to the system of measurement for ascertaining the sum payable by the power companies as rental for power disposed of in excess of the amounts for which a fixed sum was to be paid by the company, viz., 10,000 horse-power by the Canadian Niagara Power Company and by the Electrical Development Company, and 20,000 horse-power by the Ontario Power Company. The Commissioners state that with the advice of their solicitors they have rendered accounts to the Canadian Niagara and the Electrical Development Companies for the excess power generated by them. The accounts were computed upon the "increasing rental, peak power" system, as defined by Dr. Galbraith. The companies, however, claimed that under their agreements payments should be made only upon the average daily load, that is to say, the "fluctuating rental average power" system. Payment of excess rentals on this basis has been tendered by one of the power companies.

The two companies referred to have applied to the Lieutenant-Governor-in-Council for a hearing upon the matter. Until a date is fixed, arrangements have been made for the acceptance of the payments tendered, to be applied pro tempore, without in any way prejudicing the rights of either party. The financial statement included in the report shows that the Canadian Niagara Power Company has already paid excess rentals amounting to $16,655. The Ontario Power Company has not yet exceeded its 20,000 horse-power limit, and so no excess rental was payable by them.

The Commission during 1907 received from the three power companies $76,655 in rentals; from the International Railway Company $10,000, Zybach & Company $9,000, Brock's Monument tolls $996.65, wharf privileges $501, sundries $399.28, a total of $97,552.68. On capital account $37,241.75 was expended and on maintenance account $25,162.

During the heavy blasting operations by the power companies all work in connection with the installation of the systems of greenhouses for tropical plants was deferred. It is now proposed to take up this work during the summer in conformity with a general scheme which will shortly enhance the enjoyment of winter visitors to the park.

Publications.

"Successors to the dead-men" is the title of a neat booklet which the Hamilton Anchor Company, Limited, have recently issued, describing their labor-saving Swan and Atlas Guy Anchors. These anchors are for sale by all the leading jobbers of line material who, will be pleased to send a copy of the booklet to those who want to cut down their guying expense.

High Voltage Insulator Manufacture

By Walter T. Goddard.

(Continued from last Issue)

So much space has been given to discussing the value of the insulator when under rain, that its pleasant weather qualities may seem to have been overlooked. but there are sudden and severe demands upon the insulator in the pleasant weather, mainly from lightning and switching. When a rise of potential far above normal working voltage comes upon a perfectly dry insulator, the stress between line and wire and pin is very sensibly increased and that this stress shall not be too severe, the distance between line, wire and pin should be made ample by the introduction of several shells of porcelain. The specific inductive capacity of porcelain or its flux carrying capacity, is a perfectly definite thing, compared to air about 4.4, so that for any given potential, area of contact and thickness of shell, the density is determined.

Porcelain, however, unlike some dielectrics, gives due notice when overburdened, by a pale violet light over its entire surface. Fig. 9 shows two porcelain shells subjected to 100,000 volts, their very evident distress being photographed by their own light. Fig. 10 shows better than can words, how it is that so many lines have trouble with central shells breaking down. The designers in this case had failed to provide against the great concentration which will in time disrupt the finest porcelain. Fig. 11 shows one of the largest insulators ever built, being tested at 175,000 volts, its distress being very evident and presaging early break-down. How very little it takes to correct this fault is easily seen by a moment's contemplation of the fact that the stress within the porcelain will vary inversely as the square of the distance between terminals, and a glance at Fig. 12, which shows comparative tests of a two and a three-piece insulator simultaneously. From these experiments it appears that to avoid getting into serious trouble when potentials somewhere near the arcing over capacity of the insulators are applied, it is necessary to provide considerable body of insulating material between line and pin.

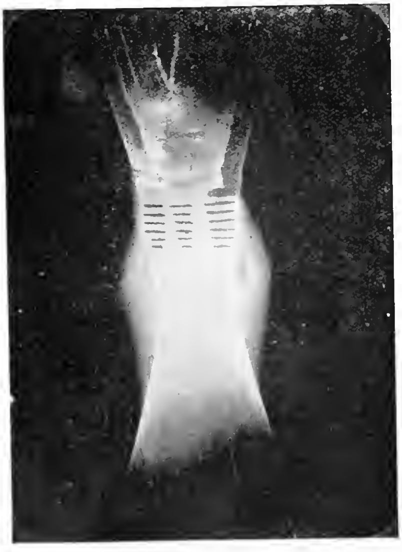


Fig. 9.

Fig. 10.

Mechanically, insulators can be designed for any load by the proper disposition of material. Good electrical porcelain has a crushing strength in excess of 15,000 pounds, and tensile strength ranging between 1,500 and 2,000 pounds. per square inch.

The latest development in excessively high voltage insulators is but a reversion to a type long since discarded by lower voltage engineers, *i.e.*, the underhung or suspended type of insulator. Reference to old telegraph manuals shows that the first English telegraph systems were insulated by underhung insulators of bowl-shaped porcelain. To come down to the present, all our trolley wires are suspended below the supporting device. For years, wireless telegraph companies have been using strain insulators in series, so the newest high voltage insulator is, in reality, the oldest. Fig. 13 shows a modern development of the underhung insulator of 5 units, designed to operate at 100,000 volts, grounded neutral, with a factor safety of 4. It is intended to allow the conductor to swing freely in any direction. Figs. 14 and 15 show towers for a 100,000 volt line using suspended insulators.

The reason for using suspended insulators is largely a matter of cost since it is entirely possible to build

FIG. 11.

porcelain insulators of the conventional type of sufficient size to successfully operate at any voltage, but the extreme height and diameter of a pin type insulator for 100,000 or 150,000 volts, makes the cost prohibitive. A suspended type of insulator has several advantages which it is well to understand before going into details of design. Of paramount importance is the unit formation making it possible to increase the effective insulation whenever it is desired to raise the line voltage or wherever it seems desirable to present extra leakage surface because of salt fogs or smoke from railways and factories. Many lines start operation at much lower potential than designed for, because the initial load is light and the potential need be increased only when regulation demands it. With the pin type of insulator there is no alternative but to invest at the start in the largest insulators which the line will ever need, whereas in the suspended form, additional units may be introduced whenever the growth of power business warrants an increase in potentials. In the pin type of insulator the nearness of line wire and pin must always prove a weak point for lightning assault as well as an aggravator of line-charging current difficulties. The suspended type gets away from both difficulties by a wide separation of line conductor and supporting structure. Incidentally the position of the conductor below the cross-arm permits the supporting structure to act as a lightning rod, and so to relieve the line of much lightning stress.

Mechanically, provision must be made to prevent the swinging conductor from coming too near the tower structure, but the extra length of cross-arm necessitated by this feature is more than compensated for in cost, by the fact that there are no twisting strains upon the arm.

Insulator unit formation presents another very positive advantage in the matter of breakage. When a shell of a pin type insulator becomes cracked or broken, the whole device is rendered worthless as it is utterly impossible to break the cement joint forming the bond between shells. Further, the cracking of a shell, especially an inner shell, may cause immediate shut-down, or at least, shut-down during the first severe rain storm. On the contrary, the breaking or cracking of one of the shells of a suspended unit type insulator takes away, but that one unit from the series; thus, in the case of a 5 unit 100,000 volt insulator, a broken unit reduces the total strength but 20 per cent.

With these very evident advantages it is small wonder that with voltages reaching toward 100,000, the underhung insulator should be adopted. The first question, that of mechanical strength, was promptly disposed of by so designing porcelain parts that strains were all compression. The next question, that of electrical

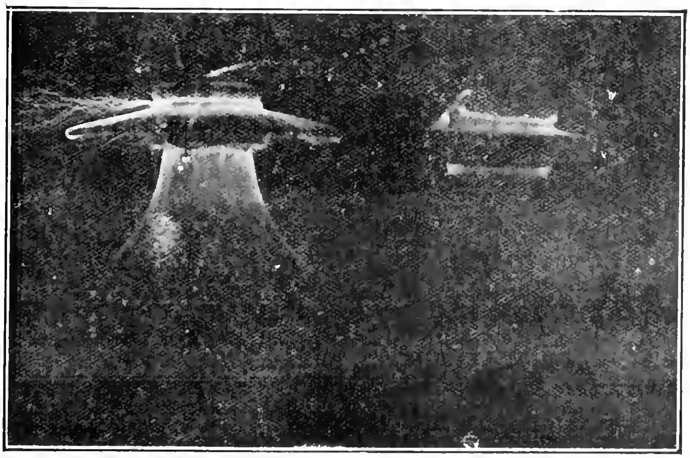


FIG. 12.

strength under normal operating conditions, was not so easily solved. In the first designs, single shells of porcelain of 5-8 inch thickness were used, but when a series of 5 such shells was subjected to a 300,000 volt test, a new condition was found to have been introduced in the way of a potential rise around the first units, and it was found by repeated test that any sudden application of potential, or even change in potential already applied, would puncture the end shells, which if made of economical pottery size, *i.e.*, 14 inch diameter, would have a flash-over potential of approximately the ultimate puncture strength. This condition analyses somewhat as follows: The shells and metallic connecting links form a condenser of certain definite capacity, which for the sake of analogy may be likened to a mass of rubber or other elastic material. Carrying out the analogy, the rubber is struck a smart blow with a hammer. The surface struck, and layers of material immediately adjacent to it, feel the force of the blow most severely, and if the mass be thick and of great inertia, the force of the blow is barely perceptible on the surface opposite to that where the blow was struck. Moreover, the elastic material is no sooner struck and compressed than it attempts to return to its normal shape. This property of inertia is duplicated in the action of condensers in series, call it what you wish, dielectric hysteresis or anything else, the effect is there, and if proper precautions are not taken, the outer layer of resisting medium, in this case a porcelain shell, will be disrupted. Unquestionably the dielectric strength of the unit must be increased, and the proper method is by supplying an inner protecting shell so that the puncture strength of the built up unit shall be far in excess of its flash-over potential. A unit so constructed is practically indestructible and will carry continuously its flash-over potential without heating or its surface being covered with static, which impairs the efficiency by shortening the leakage path. Under normal operating conditions the end unit is the only one which is subject to unusual strains, but the failure either by mechanical breakage or arcing over, may at any time put similar strain upon the other units, so it is a wise provision to guard all shells against possible puncture. Having made the unit secure against puncture, the next concern is with leakage distance, which must be made of sufficient length to prevent any considerable current flow when the entire surface is covered with a thin film of water. Here again, cost governs, since the unit construction permits the use of a few large or several small parts. As noted before, 14 inches is an economical size for the potter to produce, and as the metal parts are the same for any diameter of shell, it is this size which returns most in insulation for each dollar invested. Fig. 16 shows the construction of a unit of a modern 100,000 volt insulator. The shape of the shells is not of importance since in testing to flash-over under working conditions, pains were taken to wet all surfaces thoroughly and so produce artificially the worst possible conditions; but it must not be taken for granted that leakage over

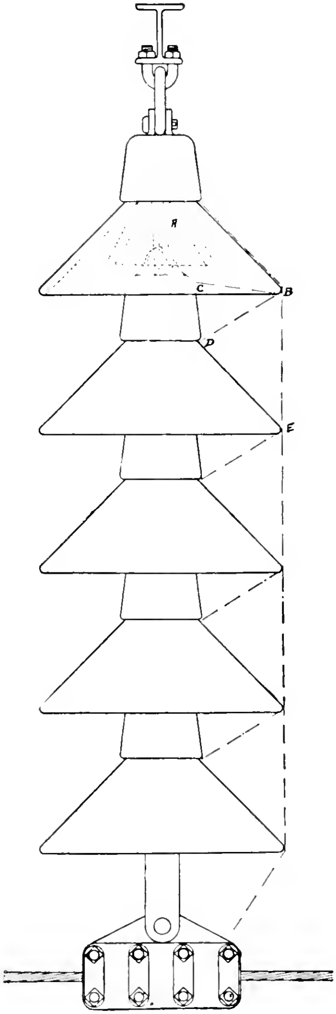
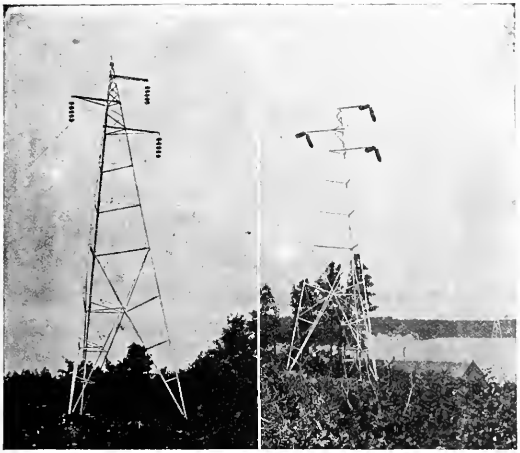


Fig. 13.

an insulator is a desirable thing, in fact, the time when an insulator will leak sufficiently to dry itself should be postponed as long as possible by logical designing. To accomplish this it is, of course, necessary to permit as little water as possible to spatter on the under side of the shells, and this is best effected by deflecting the water away rather than toward the insulator. If this were the only thing to consider, the best shape of shell would still be in question. There are, however, other conditions. When, in the course of a severe storm the under, as well as the upper shell surfaces have become thoroughly wet and leakage has commenced, the first spot to become dry is the inside of the innermost shell at the point of smallest cross-section, "A" in Fig. 13, and a small arc is at once formed which, if allowed to persist, will heat and crack the shell. To avoid this the edge of the shell is brought down till the point "B" is of such distance as



FIGS 14 and 15.

to induce the arc to play between "B" and the malleable iron cap "C" of the unit immediately below.

An arc of considerable magnitude may be maintained between these two points without heating the shells above sufficiently to cause cracking, since the air currents established tend to keep down the temperature. Current sufficient to support an arc between "B" and "C" will, unless the rain be very heavy indeed, dry a portion of the surface between "D" and "E" which causes the arc to straighten out, and if there be sufficient current at high voltage, it will eventually be held between the conductor and the supporting structure. Fig. 13 shows the progressive breaking down between the beginning of actual leakage and the maximum arc, which is not sufficiently close to the insulator to damage it. With only 500 K. W. at 300,000 volts available, the above deductions were found to be true and the ability of the design to rid itself of arcs formed upon it, demonstrated beyond question. The suspended insulator thus becomes an automatic relief valve, which may be relied upon to discharge the line safely and effectively without damage to itself or serious interruptions to the service.

The curves of Fig. 17 show action of a 5 unit insulator under partially wet and wholly wet conditions, and permit of estimate as to probable operating safety factor. The current values which were used in plotting these curves were obtained by means of a Thompson voltmeter, calibrated in amperes, introduced into the high voltage winding at its middle point. One side of the instrument was well earthed in order to protect the operator. Voltages were gotten by means of a needle gap carefully protected from air currents.

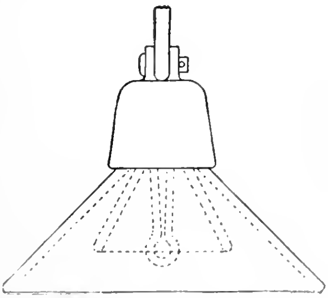


FIG. 16

The method of utilization of freely suspended insulators may be of interest. Fig. 14 shows a modern 100,000 volt line using suspended insulators, this particular tower carrying vertical load only, due to weight of cable and such side strain as may come from wind pressure. Fig. 15 shows a dead ending tower for use wherever the tower arrangements depart from a straight line. Figs. 18 and 19 show in detail how this dead-ending is accomplished, and how the cable is passed from one end-clamp to the other.

The underhung system of insulation works out with pleasing directness and simplicity, and its comparative cheapness argues for its wide adoption for the higher voltages. The cost of such insulators, as at present manufactured, ranges from $1.60 to $2.00 per unit, de-

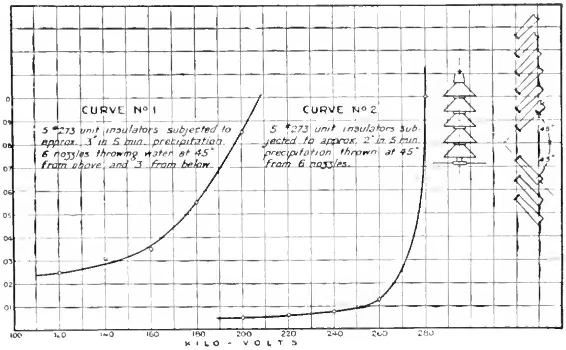


FIG. 17.

pending on the nature of the fittings. At least two 14-inch units would be required for 60,000 volts, and as good 60,000 volt insulator can be secured for prices ranging between $1.70 and $2.30 each, the question of the use of suspended units for voltages below 75,000 to 80,000 is largely one of safety, factor and investment.

The foregoing has given little which could be used in the determination of the proper insulator to use for any particular voltage, and it is quite in point to add here that every case is special. Insulators well suited to one locality are out of reason, in safety factor provided, for use elsewhere. A single transmission line of less than 100 miles in length may easily pass from high, clear mountain air to foggy, smoky, surroundings, which are a constant menace to continuity of service. Again, the cost of complete immunity may well be balanced against cost of possible shut-downs—a point well illustrated in the line operating between Niagara Falls and Syracuse,

all branch lines of which are equipped with much smaller and consequently cheaper insulators than those upon main lines.

It is not intended to convey the idea that every line should have a special insulator, but that the characteristics of the proposed line should be made known to the designer in order that all points may be well guarded against. It is quite likely the resulting recommendation will be upon an old established type, of which all characteristics are known, and though its use for any specific case may not call into use all it is capable of, it will quite likely prove cheaper to produce a standard article of larger size than to make a special design of just sufficient capacity.

A forecast of the future of any business, though never safe, is always interesting.

Concerning the highest practicable voltage, without reference to anything but insulators, it is safe to say that insulators for the heaviest mechanical strains and for the highest electrical stresses can be manufactured at moderate cost, so that limitations of transmitting voltages must at the present time be looked for in other directions than in insulator design, porcelain insulator design in particular.

Whenever the word insulator has been used, porcelain insulator is implied, for no other material has been so universally used in the past, and none gives such promise for the future. Its one bad characteristic, that of brittleness, is overcome by good designing; otherwise, the material is very nearly ideal, for it is cheap and comparatively easy to manufacture. Of prime importance is its permanency, and of no other manufactured dielectric can as much be said. Porcelain is made under extreme conditions of heat, which effects the cementing together of stable elements, which have been in their present form for thousands of years, and under the conditions at present obtaining on the surface of this planet, will remain unchanged. Moreover, the porcelain is homogeneous and of a uniform texture throughout and consequently of uniform specific inductive capacity throughout, so that electrical strains are evenly distributed. On the other hand, organic materials are subject to very rapid deterioration; many unite with oxygen at ordinary temperatures or are attacked by rain water in a very short time. Heating by condenser action also aids in oxidation processes and hastens the end. A favorite method of insulating against low voltage is by means of compositions of rubber, gutta-percha, pitch, asbestos, ground mica, shellac, and the like, but the result is always the same, and a moment's contemplation of the reasons of failure would seem to argue against their use for permanent exposed insulation.

The past is full of unhappy experiences in the attempt to insulate high voltage lines with glass, rubber, mica, etc., and occasionally an engineer is found who is willing to erect lines of high pressure on insulators of material other than porcelain, but such engineers are so rare as to make it safe to say that, as a permanent dielectric, porcelain, to-day, stands alone.

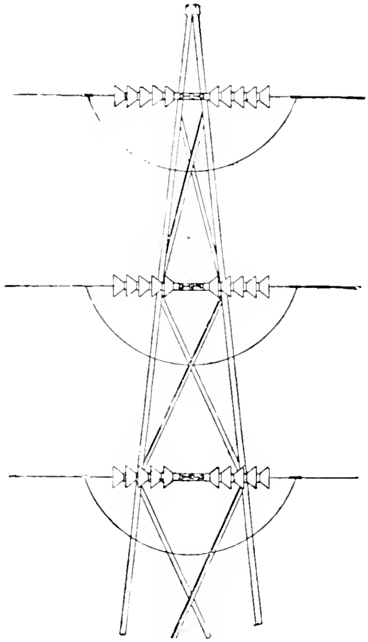


Fig. 19.

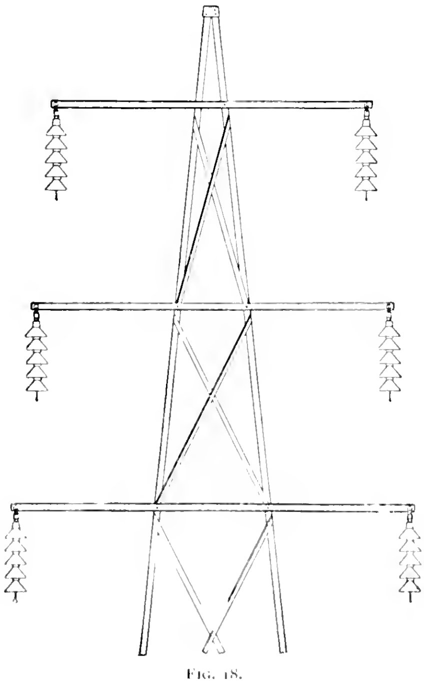


Fig. 18.

Electrical Engineers Discuss Transmission.

A special meeting of the Toronto Section of the American Institute of Electrical Engineers was held on the evening of Monday, March 30th, at the rooms of the Engineers' Club, thirty-one members and eight visitors being present, twenty-one of whom were present at the luncheon held prior to the meeting.

The chair was occupied by the chairman of the section, Mr. K. L. Aitken, and the address of the evening was made by Mr. David B. Rushbore, of the Schenectady section, who discussed "Some Factors in High Tension Power Transmission." Mr. Rushmore's address was illustrated by the use of a considerable number of lantern slides. Among other things, he drew attention to the gradual removal of the limitations in the matter of transmission voltage, illustrating this fact by the recent remarkable improvement (1) in line insulators, and (2) in lightning arresters; the results of improvements in which have permitted the installation and operation of at least four lines in America at voltages higher than 60,000, one of which is designed for from one hundred to one hundred and twenty thousand volts. He referred to the fact that the limit which had been removed, and whose removal permitted the use of the now common sixty thousand volt lines had been the result of considerable improvement in the insulation of transformers and of the development of the multi-gap lightning arrester.

The first view shown was of a stroke of lightning, in discussion of which the speaker drew attention to the fact that recent studies had shown that the damages sustained from such electrical disturbances are unimportant when compared with those resulting from high resistance grounds on well insulated lines in either overhead or underground systems. Other subjects illustrated were the aluminum arrester, whose characteristics and principles were devolved; recent designs of very high tension oil switches and air brake switches. Several different types of station design and arrangement were discussed.

In concluding his remarks, Mr. Rushmore complimented the section upon taking the initiative toward the establishment of a new grade of membership in the Institute. He then outlined his ideas of the probable development of the Institute, if it were to attain its proper functions in American progress. His chief proposition was to the effect that the developed Institute would become more truly a federation of active scattered local sections than a small central body with more or less independent and therefore merely weak scattered groups of members.

A rather full discussion was taken part in by Prof. T. R. Rosebrugh, of the University of Toronto; Messrs. Converse and Ryerson, of Niagara Falls; Glasco and Darrall, of Hamilton; and Kyonch, Lambe, Black, Bucke, Price, Watts and Mitchell, of Toronto. The greater part of the discussion centred around the subjects of "lightning arresters" and "location of the centre of control in power stations"; Messrs. Converse and Ryerson expressing satisfaction with the control in the hands of chief operators absolutely isolated from the machinery of the power house and in presence only of the indicating apparatus, while Mr. Black declared a distinct belief that the operators should be able to see the machinery they are controlling. Mr. Glassco set forth briefly some of the chief experiences of the Cataract Power Company of Hamilton, with which he is connected, one of the most interesting items of which related to the voltage stresses resulting from the use of an open delta on the three-phase lines.

A vote of thanks, on motion of Messrs. Black and Ryerson, was tendered to Mr. Rushmore for his courtesy in coming to Toronto and addressing the section.

The next meeting will be held at the University of Toronto, on the evening of Friday, the 17th April, and will be addressed by Mr. H. W. Price on "The Oscillograph." The lecture will be illustrated by use of the instrument and by means of slides.

Wireless Service Working Smoothly.

In a lecture delivered before the Royal Institution in London, Marconi stated that communication across the Atlantic by his new plant has never been interrupted for more than a few hours at a time since the commencement of commercial work on October 17. Mr. Marconi referred to the difficulty met with in transmitting during certain hours of the day. These periods, he said, come in the morning and evening, when daylight or darkness extends only part way across the Atlantic. He read a letter from the New York "Times," in which it was stated that since October last that journal had received from its correspondents in England and on the continent news despatches totaling 68,404 words, promptly and efficiently transmitted by wireless.

August 17 will be the fiftieth anniversary of sending the first cable message across the Atlantic Ocean. In August of 1857, the first attempt to lay a cable was made, but about 300 miles from the Irish coast a strain caused by a sudden dipping of the sea bottom caused the cable to part, and the attempt was for the time abandoned. A message of 90 words from Queen Victoria to President Buchanan, which took 67 minutes to transmit, was sent through the 1858 cable, but after a few following short messages it ceased to transmit signals. One of the electricians on the U. S. S. Niagara, which, together with the British war vessel, Agamemnon, laid this cable, always maintained that no message was ever sent, and that the message to Buchanan from Queen Victoria was "cooked up" for commercial purposes, his ground being that the cable had ceased to test out long before reaching the Newfoundland coast, and that on several occasions in paying it out accidents had occurred that had destroyed the insulation of the cable. In 1865 another unsuccessful attempt was made to lay an Atlantic cable, and the first operative cable was not laid until 1866.

QUESTIONS AND ANSWERS

GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS:

1. All enquiries will be answered in the order received, unless special circumstances warrant other action.
2. Questions to be answered in any specified issue should be in our hands by the close of the month preceding publication.
3. Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment should be placed in the hands of a consulting engineer, caot be considered in this department.
4. To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possible doubt as to the infor mation required.
5. In all cases the names of our correspondents will be treated confidentially.

Question No. 1.—What is the efficiency and power factor of the mercury rectifier?

Answer.—As there is a constant drop of about 14 volts across the tube, the efficiency will obviously vary with the size of the set and the current flowing. It runs in the smallest capacities about 25 per cent., rising to about 85 per cent. as a maximum for the largest sizes when operating at full load, these latter thus comparing most favorably with a motor generator set. The power factor is fairly constant for all sizes and loads, averaging about 85 per cent.

Question No. 2.—Has anyone ever tried the use of grease on trolley wires to prevent sleet troubles, and if so, has it been successful?

Answer.—The use of grease on trolley wires has been mooted several times, and has been tried now and again, in fact we believe that there is a petroleum compound on the market, known as trolley wire grease. As far as we know the grease helps matters very materially, but the cost and trouble of putting it on have prevented the method ever coming into extensive use. Probably the best method of getting over the difficulty is to use a sleet cutter or a sleet trolley wheel, several good makes of which are on the market.

Question No. 3.—Do you think that it is necessary to put in 10 ampere meters for ordinary house services, as I understand that one or two of the largest companies buy nothing but 10 ampere meters?

Answer.—This will all depend on the size of the house; that is, how much load there is to carry. A 5 ampere meter will actually carry double its rated load, or 10 amperes, which is equal to about twenty sixteen candle power lamps. You will very seldom get more than 75 per cent. or 80 per cent. of the lights in a house burning at one time, which means that this load would not be obtained from a house that had less than about 25 lamps. Further, these 25 will seldom be all 16 candle power, so that the permissible number of lights on a 5 ampere meter is still further enlarged, probably 30 or 35 outlets. Even more than this, depending on the candle power of the lamps and the style in which the occupants live, is not too large an estimate. Another point to be considered is that you can afford to burn out an occasional 5 ampere meter and still be money in pocket, as opposed to using many of the 10 ampere size, as the former costs about $1 less to purchase and exactly 50 cents less to seal. Besides this there is less tendency for the 5 ampere meter to run slow on light loads. This is a most important point, as a large part of the total energy recorded by the average house meter is made up of very small loads, the periods during which it is operating at anything approaching full load being few and far between.

Regarding your point that some of the largest Canadian companies are buying nothing smaller than 10 ampere meters, we would say that as far as we know this used to be the case, but lately practice has been changing.

Question No. 4.—I have some transformers operating on 125 cycles which I want to run on 60 cycles. (a) What variation will this make in the core loss? (b) If I buy 60 cycle transformers how will I be able to operate them on 25 cycles later on?

Answer.—(a) It is almost impossible to answer such a question in general terms, because the ratio between the two core losses varies with different types and makes of transformers. For fairly modern core type transformers you will probably find that in the smaller sizes your core losses will go up, say 35 per cent. to 45 per cent., while the medium and larger sizes will not increase quite so much, say 25 per cent. to 35 per cent.

(b) It depends entirely on the design of the transformer, some you can, and some you cannot so operate. If the density of the flux at 60 cycles is not too high they will as a rule operate within a safe temperature on 25 cycles, but it is entirely a matter of experiment, or of advice from the makers of the particular transformers in question. It should be noted that the ratios between the 125 cycle and 60 cycle core losses will not hold as between those at 60 cycles and 25 cycles, the increase in the latter case being 10 per cent. to 15 per cent. greater.

Question No. 5.—Can you give me a reliable receipt for fixing a hole in the mica between the commutator bars of a generator?

Answer.—The best way is to put a new mica in, either by dismantling the commutator right in the generator, if it is a large machine, or if small by sending it to a reliable repair shop. As a temporary expedient you can either drive in a fresh piece of mica, bedding it in shellac to hold it in place, or you can fill the hole by a mixture of litharge, glycerine, and water glass. The bars should be heated after the hole has been filled, so as to harden the mixture. You should of course clean the sides of the hole thoroughly, so as to get rid of all charred and carbonized material, before you put anything into it, otherwise the sides of the burnt place will act as a conductor, and you will have more trouble in a very short time.

Question No. 6.—I saw a motor generator set running the other day with a contact on one end of the shaft which was flashing all the time, also it appeared to light a lamp up on the switchboard. What was the object of this?

Answer.—The device you speak of was probably an end play equipment, the flash you saw being just the breaking of the current that energizes the magnet. The arrangement is put on machines like motor generator sets and rotaries that tend to settle to one place in their bearings, due to the fact that there is no belt or other equivalent device to make them oscillate throughout the limits of the end play. The objection to settling in one place is that the bearings, journals, and commutator all get worn in bad grooves, which is of course very undesirable. The lamp you saw was used either as a resistance or else as a means of notifying the switchboard man that everything was working properly, perhaps it performed both duties. The later end play devices are entirely mechanical, a spring replacing the magnet used in the first designs.

Question No. 7.—How does the viscosity of oil affect the operation of oil-cooled transformers, oil switches and bearings?

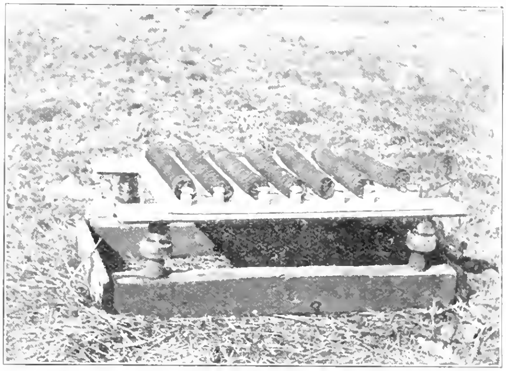
Answer.—It affects the operation of oil switches and transformers quite materially, though it has not so much affect on bearings. Oils of low original viscosity, that is, those which flow freely, are preferable for oil switches in one respect, namely, that they follow after the switch blades more quickly than thicker oils, and thus extinguish the arc more rapidly, and perhaps more certainly. In transformers, other things being equal, they are also better than thicker oils because, on account of their comparative thinness, they flow more easily and therefore there are more connection currents set up in them, thus resulting in a somewhat lower transformer temperature. On the other hand, the thinner oils generally have a lower flashing point than those of greater viscosity, which means that they are somewhat less able to extinfire. The point is not of so much importance in small transformers built for moderate potentials, but becomes of great consequence when dealing with the higher voltgnish an arc, besides being rather more liable to catch ages. The viscosity of oil is generally increased by overheating; consequently, any oil which at first was quite suitable for use in a switch or a transformer may be rendered unsatisfactory by improper use.

In bearings a comparatively thick and viscous oil may be used, the heating of the journal as a rule reducing the viscosity until the oil flows freely enough to be entirely satisfactory.

The Hydro-Electric Power Commission are stated to have come to a final agreement with the Government and will be ready to call for tenders for the transmission of Niagara power just as soon as the various municipalities have signified the amount of electricity they will require. Government lines will probably be constructed through much of the territory.

Plant Forcing by Electricity.

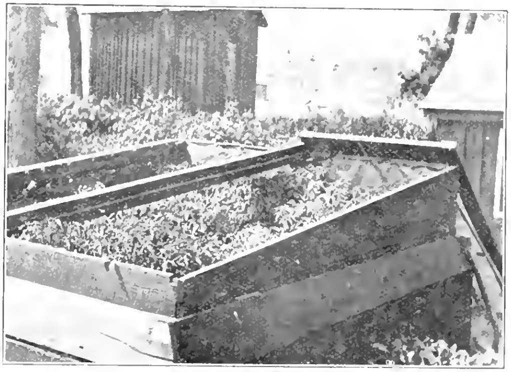
An electric hot bed, used by a correspondent from Turbine, Ont., is shown in the accompanying illustrations. Although of simple construction the idea involved is so promising of results as to make it interesting. About 260 feet of iron wire (12 B. & S.) are used, wound in seven coils, 2 inches in diameter, and connected in series. The coils are set up on knobs, on a piece of asbestos board. They are placed under a rough board frame,



Electric Hot Bed for Plant Forcing.

the floor of which is covered with about 5 inches of earth. The frame is covered with 3 foot by 8 foot hot bed sashes.

The current is taken from a 110 volt direct current circuit, but owing to line losses the current actually



Plants Raised by Electric Hot Bed.

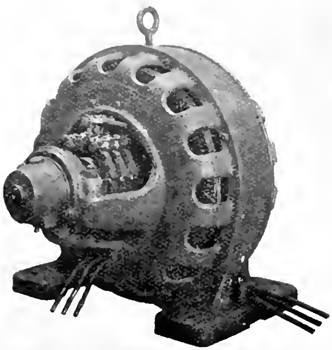
received at the heater was: last year, 15 amp. at 80 volts; the previous year, about 18 amp. at 100 volts. Both gave good results.

At this season, forcing houses and hot beds are extensively used and the application of electricity to them might prove an important step in advance. The heater shown is only a home-made affair, but has given excellent results for vegetable and flower plants. It has been

used early in April in the comparatively cold climate of New Ontario, and the current mentioned has proved quite sufficient.

A New Type of Induction Motor.

Electricity is now so universally recognized as an economical and flexible method of power distribution, that the proper selection of apparatus becomes an all-important matter. The flexibility and economy of the alternating current method of power distribution has led to its almost universal adoption in central station service, and because of the economy of the use of this central service many industrial plants are now purchasing power. The same features that led to the selection of alternating current generation and distribution for central stations have, in a somewhat lesser degree, led to its distribution for large industrial works. On account of this it was necessary to provide alternating current motors of varying characteristics. The earlier polyphase motor was of the brushless or squirrel cage type and compared more nearly with the shunt wound d. c. motor.



WESTINGHOUSE COY'S. "H.F." MOTOR.

To meet the varying conditions imposed by high starting torque with a low initial starting current, a modified form of motor has been produced by the Westinghouse Electric & Manufacturing Company, known as the type "HF." The general appearance of this motor is shown in the illustration, from which it will be noted that it is especially rugged and substantial. The frames are amply ventilated, but so constructed as to protect the laminations from injury. Throughout, the motors have been designed for hard service. The insulation on the coils has been very thoroughly made and will stand much greater stresses than it receives in normal service. It is furthermore so built that vibration, and consequent wear of the insulation, is prevented.

By means of the brushes connection is made with an external resistance. The brushes bear on continuous rings of metal, so that there is no occasion whatever for sparking. The brushes are liberally proportioned, so that they have long life and require the minimum of attention. The motor is unlike the usual short circuited type of armature on induction motors, and has a regular winding in which the resistance is inserted while starting, and thus the starting current is limited. Approximately full load current is required to produce full load starting torque. Special covers are provided for enclosing the brushes where this may be desired. Type "HF" motors are built in the usual sizes from 5 to 500 horse-power, with larger sizes on special order. The standard frequencies are 25, 40 and 60 cycles, but motors for other frequencies are supplied when required.

In connection with these motors, special starting devices are supplied by which the current at starting is varied by hand. These starters cut resistance out of the circuit of the rotating armature until the handle reaches the full-on position, when the resistance is all short circuited and the motor runs with practically the constant speed characteristics of the squirrel cage armatures. A special short circuiting switch is provided on motors of 100 horse-power or larger if desired. This relieves the brushes and the leads and contacts on the starter, as the windings are short circuited inside the motor.

Canadian Electric's Dividend Cut.

At the last meeting of the directors of the Canadian General Electric Company the dividend was cut from the 10 per cent. basis, which the company has been paying for the last ten years, to a 7 per cent. annual basis. The stock of the company, which has dropped to 90 from par since the first of the year, sold as high as $235 in 1901, and as high as $178 in 1905. It was said by one in authority that the dividend reduction was merely a precautionary measure taken in view of the uncertainty of industrial conditions. The quarterly dividend of 1 3-4 per cent. on the three months ending March 31, on the common stock, represents a 3-4 per cent. reduction on the 2 1-2 per cent. quarterly dividend declared heretofore. The directors also declared a semi-annual dividend of 3 1-2 per cent. on the preferred stock.

Insect Electrocution.

An electrocutor for insects is the latest invention credited to electricity. Mr. A. L. M. Chaulin, of Paris, France, is the inventor. The contrivance is the acme of simplicity, consisting of two metallic rings joined by a large number of chains so as to form a hollow collapsible cylinder. The chains are spaced a small distance from each other so as not to touch. An inquisitive insect crawling or flying between two neighboring chains is promptly electrocuted. Fuses prevent damage by short circuits when two chains accidentally touch. The dead insects are saved the torture of a slow death, as on sticky paper, and they do not carry any insect poison about the house.

Heating System in the New Factory of Jenkin's Bros., Limited, Montreal*

The new factory of Jenkins Bros., Limited, at Montreal, consists of a main building and office about 203 feet by 54 feet, a storage room 36 feet by 63 feet 6 inches, a brass foundry 107 feet 5 inches by 63 feet 6 inches, a small pattern vault, and an engine and boiler house 54 feet 10 inches by 38 feet 8 inches.

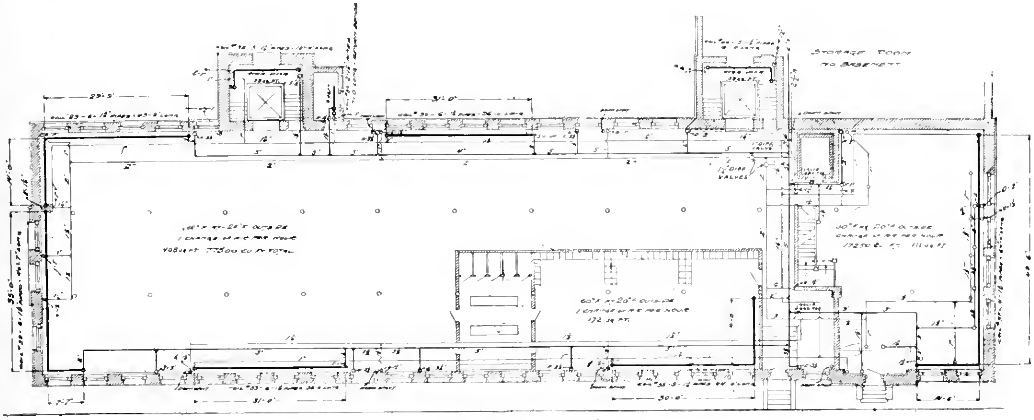


FIG. 1—BASEMENT OF MAIN BUILDING.

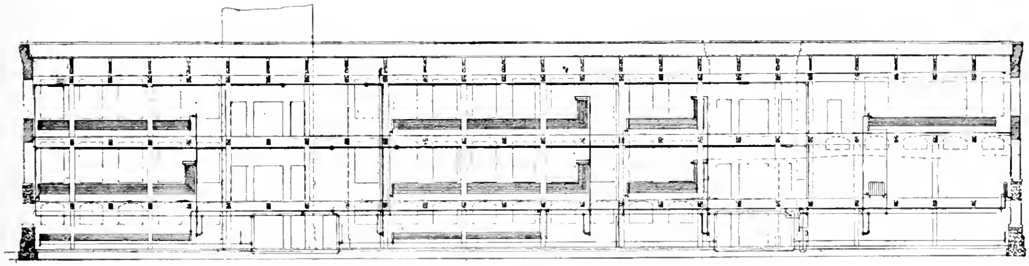


FIG. 2.—LONGITUDINAL SECTION OF MAIN BUILDING, LOOKING NORTH.

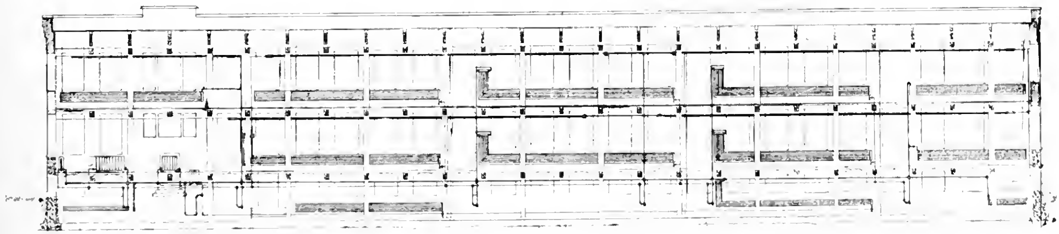


FIG. 3.—LONGITUDINAL SECTION OF MAIN BUILDING, LOOKING SOUTH.

In heating these buildings a vacuum system is employed. The heating main is run overhead, straight from the power house wall and across to the foundry building. Over the passage it is suspended from wire cables stretched between the two buildings, a distance of 20 feet. Inside of the foundry building the main is hung from the floor and the floor girders. It is run through the foundry and casting storage buildings and the basement of the main building as shown in Fig. 1. The size of the main and its branches is shown on the plans.

The manner of running the steam and return risers is shown in the sectional drawings, Figs. 2 and 3. They are fastened to the wall. The steam risers are drained into the return system by means of drip loops, as shown in Figs. 2 and 3.

The returns are run as shown in the drawings and are

*By courtesy of the "Engineering Review."

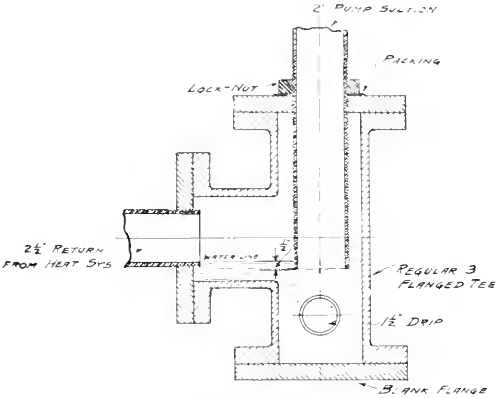


Fig. 4.—Detail of Section T in Pump Pit.

equipped with differential valves at the points indicated on the drawings, a globe valve and dirt strainer being placed in front of each differential valve.

The returns from the coils in the basement of the main building are kept separate from the rest of the system, and all run on the walls under the coils, as shown in Figs. 1, 2 and 3. They enter the main return pipe from above and through a check valve. Where the returns are carried below their proper grade, as in passing under a door, a pipe one size smaller than the return at that point is also carried over the door, as shown in Figs. 2 and 3.

The returns from the main building, except the basement, are run near and about one foot below the steam mains.

The returns from the casting storage building and from the foundry building are run on the wall above the top of the foundations.

The main return pipe is run from the basement of the main building to the power house, underground. It is inclosed in a box 6 inches square inside, made of 2 inch plank. This box is laid just below the bottom of the concrete floor in the casting storage building and continued at the same depth across the foundry building. Outside of the buildings the top of the box is 2 feet below the surface of the ground. The return terminates in

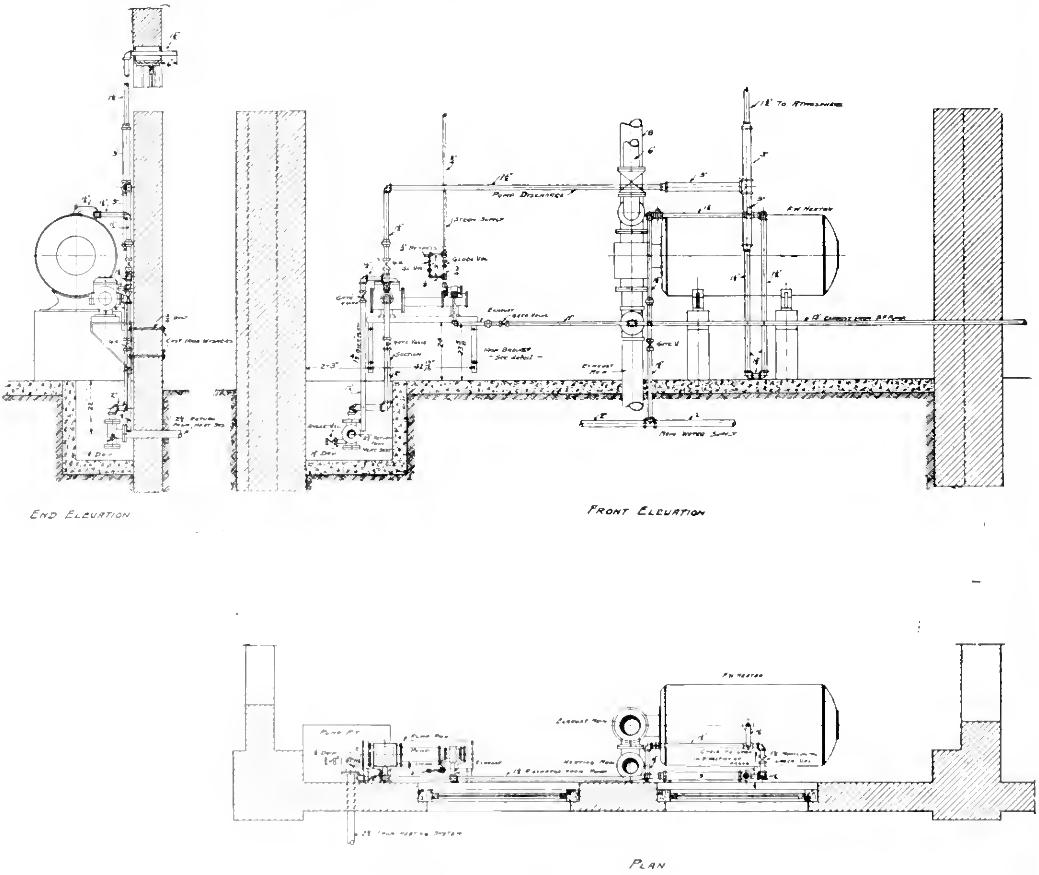


Fig. 5.—Vacuum Pump Connections and Details.

a suction T located in a pit adjoining the power house. The manner of making this T is shown in Fig. 4.

The pipes, including mains, returns and heating coils, have a uniform slope in the direction of flow of quarter inch in 10 feet.

The vacuum pump is located in the engine room, and is piped to the suction T on the main return pipe, delivering the drips into the delivery tank, and through it into the feed water heater.

A plan and section of the vacuum pump and feed water heater is shown in Fig. 5.

A 6 inch by 6 inch by 6 inch T and 6 inch gate valve are placed in the steam main just inside the power house wall, to provide for the use of live steam, which is supplied through a reducing valve.

T's 2 1-2 inches by 2 1-2 inches by 2 1-2 inches, and 3 inches by 3 inches by 3 inches, and waste valves 2 1-2 inches and 3 inches, respectively, are placed in the branch steam mains in the basement of the building, which supply the office and draughting room radiators to provide for heating these radiators with live steam when the factory is not running. These tees and valves are indicated in Fig. 1.

The heating coils are constructed of 1 1-4 inch wrought iron pipe. Manifolds, or branch tees, are used except where return bend coils are indicated. The wall coils are mounted on hook plates. The top of the coils are 1 inch below the line of the window sills, except in the basement of the main building, where the bottom of the coils are 18 inches from the floor. Overhead coils are hung in a horizontal plane, or pipe hanger rolls, so as not to interfere with workmen on the floor.

RADIATORS INSTALLED.

Height.	Sections.	Valve.
38 inches	8	1 inch
38 inches	12	1 inch
32 inches	15	1 1-4 inch
32 inches	15	1 1-4 inch
32 inches	15	1 1-4 inch
38 inches	14	1 1-4 inch
38 inches	14	1 1-4 inch
38 inches	4	3-4 inch
38 inches	19	1 1-2 inch
38 inches	19	1 1-2 inch

A dirt pocket, made as shown in Fig. 6, is placed on the drip connection of each coil, but not on the radiators, with the size of radiator valve used on each. The drip valves are all standard 3-4 inch bodies.

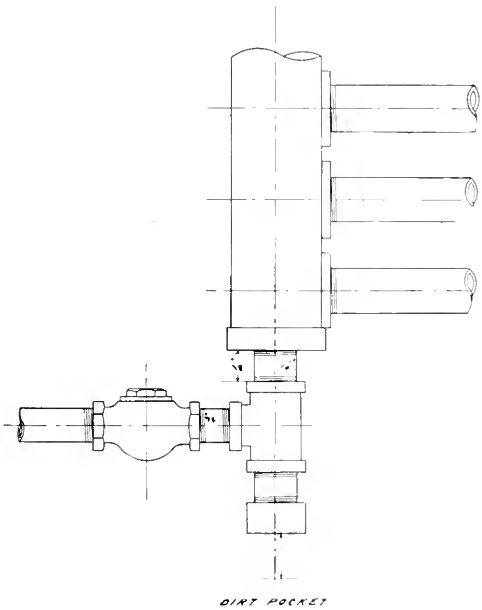


FIG. 6.

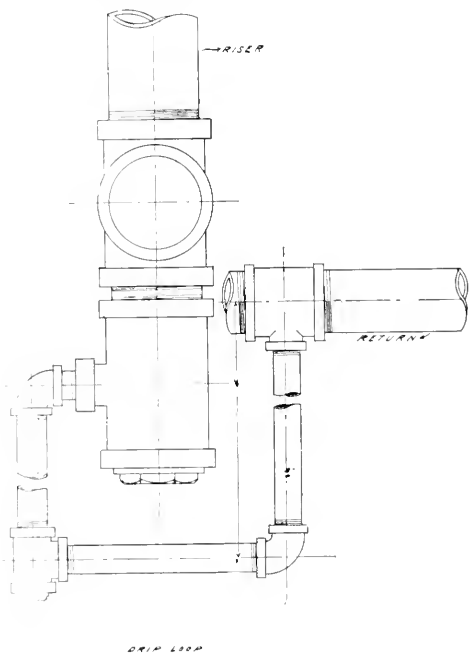


FIG. 7.

The radiators are set 3 inches from the wall.

The radiators were manufactured by the Dominion Radiator Company. The vacuum system installed is known as the Positive Differential System of Steam Circulation.

The drawings and specifications were prepared by Barton & Carpenter, consulting engineers, 90 West street, New York. James Ballantyne, Montreal, did the steamfitting.

A new wireless station will be erected at Victoria, B.C., by the United Wireless Telegraph Company. C. B. Cooper, of Seattle, is general superintendent of construction for the Pacific coast.

Canadian Company Prospering in Mexico.

The annual report of the Mexican Light & Power Company, which has just been published, shows the company to be in a prosperous condition and also that it is one of the greatest foreign industries operating in Mexico. The company is a Canadian one, Sir George Drummond being president and the head offices being at Montreal. Other well-known Canadians connected with it are Messrs. J. H. Plummer, A. S. Clouston and F. L. Wanklyn, of Montreal, and Mr. E. R. Wood, of Toronto.

The value of the company's investments in Mexico is placed at more than $40,000,000. The work of adding to the great plant is still in progress and preliminary steps have been taken to extend the business of the company to other portions of the republic.

The report shows that during the last year there was expended on capital account a total of $2,475,331 gold, of which more than $1,000,000 was laid out in the work of completing the hydro-electric plant at Necaxa, near the city of Mexico. Approximately $1,000,000 was expended on distributing lines and equipment in the city of Mexico and the Federal district. The sum of $350,000 was spent during the year on the installation of the second hydro-electric plant, which has cost $668,000 gold up to December 31, 1907.

The company has expended a considerable sum in constructing a provisional dam at Los Reyes and in driving a tunnel to connect the Laguna reservoir with that of Los Reyes. The Laguna dam has been raised to a height that will provide a storage capacity of 30,000,000 cubic meters of water.

Satisfactory progress is being made in the construction of a great dam at Necaxa. The material to be used in the construction of this dam will amount to 1,634,000 cubic meters. The lower part of this dam is now raised to a height of about 60 feet above the river bed. This storage reservoir will be used to supply the large hydro-electric plant that was first erected. The reservoirs which the company now has under construction will have the following ultimate capacities: Necaxa, 44,852,600; Laguna, 44,013,000; Los Reyes, 26,179,200 cubic meters.

In addition to the large amount of electric power which the company is now supplying in the city of Mexico and the other towns of the Federal district, in the city of Puebla and to many mining concerns in El Oro, the demand for more power is much greater than it can now supply. It has tentative contracts for supplying additional installations representing 3,000 horse-power capacity in motors. This is exclusive of the contract which the company has already made with the federal government by which 3,000 horse-power is to be furnished for the purpose of operating the pumps of the big waterworks and drainage systems of the city of Mexico. The supplying of this power will probably begin the latter part of this year.

The company has many transmission lines reaching out in all directions from its Necaxa plant. The longest of these is 175 miles. The demand for electric power with which to operate the machinery of mines and industrial plants as well as the street railway lines is great, and it is planned by the company to supply this demand to all within a radius of 200 miles and more from its Necaxa plants.

The Illuminating Engineer's Field.

The relation of illuminating engineering to architecture from the engineer's standpoint was recently discussed at the New York section of the Illumination Engineering Society. Mr. E. L. Elliott said in a paper on the subject that there is a considerable degree of feeling among modern architects that the engineer and his work constitute a sort of necessary defilement of the rarefied spiritual atmosphere in which they should by right dwell. The modern architect seems to have only one anchorage in which he has implicit faith and that is veneration for antiquity. The much admired ancient structures were wonderful embodiments of the highest degree of artistic taste and originality, but they remain as monuments of the most debased form of human labor conceivable, namely, hopeless and abject slavery. Strictly speaking, there are no remnants of any ancient structure which show the application of true engineering prinples. Building to-day has become almost entirely an engineering problem; and with the vast increase in the complexity of life which characterizes modern civilization, has arisen the necessity of sub-dividing the general problem of construction into a number of distinct branches. Among these are the purely mechanical construction, which has given rise to structural engineering; the methods of heating and ventilating, with its special engineering; electrical equipment, with its electrical engineering; provisions for sanitation, with its sanitary engineering; and last, the necessities for artificial illumination, demanding illuminating engineering. All but the last mentioned of these special branches of engineering have gradually been necessitated in the evolution of building, and have been accepted by both architect and client. It is only the last that is still to some extent in the undeveloped state. The advent of the illuminating engineer as a specialist should be hailed with greater delight and relief by the architect than by any other member of the community. Having satisfied himself of the competency of the illuminating engineer, just as he would satisfy himself of the competency of the electrical, or construction engineer, the architect can turn over the plans of the building, with the specifications of the use or uses to which it is to be put, and probably also a statement of the illuminant to be used, and leave the entire technical problem to the illuminating engineer. A careful analysis of the respective provinces of the illuminating engineer and the architect discloses no more ground for mutual disagreement and distrust than between the architect and any other engineering specialist.

New York Central Electrification Results.

The results of the change of motive power in the initial electric zone on the New York Central Railway are summed up by W. J. Wilgus in the "Western Electrician" as follows:

(1) Abolition of nuisances incident to the steam locomotive.

(2) Increased capacity of the Grand Central Terminal.

(3) The promise, with the completion of the changes, of a saving in cost of operation of from 12 to 27 per cent., after providing for increased capital charges for electrification.

(4) The outlook of a large future growth of remunerative traffic and other sources of revenue attendant on the use of electricity, much more than sufficient to provide for the increased capital charges for the other improvements.

Several years will be consumed in the gradual rounding out of the work as a whole; but it is gratifying to have this early indication of the success of the undertaking from both the engineering and financial standpoints.

Other Operating Conclusions.—Apart from these results, it is interesting to note the conclusions, suited to this particular problem, that may be drawn from a study of the various observations.

Equipment designed for the electric system over which it is to operate offers economies so superior as to overshadow any other advantages that may be claimed for a kind of equipment that can be operated over several systems.

In switching service the economy of electric traction lies in savings for supplies, and in lower unit fixed charges and repairs due to less lost time for repairs and care.

In slow speed hauling, the advantage lies in the lower unit fixed charges and repairs of the electric locomotive, due to its ability to do more work while busy, and to less lost time for repairs and care.

High speed road service shows advantages for electric traction in all three items—supplies, wages and fixed charges and repairs. The small 18 per cent. increase in current consumption for the greater speed of road service, as compared with hauling service, is in marked contrast to the 165 per cent. increase in coal consumption for steam traction.

Opportunities for large economies lie in the thorough training of motormen in the manipulation of their controllers, a very simple problem as compared with the difficulties of teaching both the enginemen and firemen on steam locomotives to perform their duties so as to result in fuel economy.

Maintenance of Track and Structures.—It is yet too early to express in dollars the comparative effect of steam and electric traction on the cost of maintaining and renewing tracks and structures. Repeated systematic inquiries of all foremen in charge of electric zone track maintenance, and of the motormen operating electrical equipment have brought out the practically unanimous opinion that the effect of electric locomotives, apart from slightly greater wear on switches, does not differ from steam motive power on either line or surface of tracks, but that the former has better riding qualities. The superiority of electric traction is manifest, of course, in the cessation of costly corrosive action of locomotive gas or metallic structures, and the freedom from cinders which, with the steam locomotive, cause heavy maintenance costs for cleaning, rock ballast and pointing brick tunnel arches.

Crocker-Wheeler Company's Canadian Officers.

The officers of the new Canadian Crocker-Wheeler Company, Limited, are well known to the electrical and manufacturing trade in Canada. Mr. F. E. Lovell, president of the company, is a member of the old established lumber firm of H. Lovell & Sons, of Coaticooke, P.Q., who have extensive interests in mills and timber limits throughout the Province of Quebec.

Messrs. Russell A. Stinson and F. John Bell, vice-president and secretary-treasurer respectively, have been identified with the manufacturing, construction and sales ends of the electrical trade in Canada for the past fifteen years. They are particularly well known in Montreal, where they are welcoming their many old friends. The head office of the company at Montreal has been recently opened in the Street Railway Chambers, Place d'Armes Hill.

Power Development on Dog Lake.

Hon. Mr. Beck has introduced a bill in the Ontario Legislature to provide for the development of water power at Dog Lake. It provides for the construction by the Hydro-Electric Power Commission of a dam or dams in Dog Lake or in the Kaministiquia river for the purpose of storing and controlling the flow of water. The Commission will develop electrical energy, and may sell or lease such water power to such persons, firms or corporations as the Government may see fit. The Commission is given power to regulate the use of the waters of the river by the owners or lessees of any water powers below the Log Lake dam. The cost of the work is not to exceed $20,000, and is to be paid out of the consolidated revenue fund of Ontario. It is understood that the bill is introduced in connection with Port Arthur's power scheme.

The Western sandbar on Toronto Island is in danger of being washed away if the waters of the lake continue to rise. A large section of sidewalk has been washed away, along with many of the groynes constructed by the residents. The highest point on the bar is now only a foot above the level of the lake, and the water is 33 inches above zero, with a prospect of it reaching 40. The City Engineer is unable to protect the cottages, and in the neighborhood of 50 houses are in danger of being washed away.

"Slow-Burning Weatherproof" Indoors.

The following letter regarding weatherproof wire has been received from Mr. H. F. Strickland, Chief Electrical Inspector of the Canadian Fire Underwriters' Association at Toronto: "I notice in your March number of THE ELECTRICAL NEWS, among the questions and answers, that some one states he has received a circular from the Canadian Fire Underwriters (not the Toronto section) stating that slow-burning weatherproof wire is not allowed inside buildings. That there is a mistake about this I am quite convinced. In the first place, there is no other department in this part of the country which sends out any electrical bulletins or circulars, and if any circulars were sent other than from either this office or Montreal, they were not official Underwriters' electrical bulletins, as all these matters in both Ontario and Quebec are issued by either the Montreal or eastern division, or the Toronto or western branch of the Association. I note, however, the reply to his answer was very fair and quite correct, and in order to satisfy your readers and correspondents that any circulars which we have sent out, ruling on this question, are in accordance with the code. I quote you from our No. 8 Bulletin, as follows: 'Also the use of ordinary weatherproof wire was prohibited on and after January 1st last and for all inside open work slow-burning weatherproof wire is to be used except in damp and concealed places, in which locations approved rubber covered wire should be used as heretofore.'

"This certainaly would not bear out your correspondent's contention. I might also add in conclusion that any question asked in interpretation of the Underwriters' rules will be cheerfully furnished upon application."

Exit the Flexible Cord.

The Fire Underwriters' Association are forwarding bulletins to the electrical contractors and supply houses in Toronto notifying them that on and after May 1st next the use of ordinary flexible cord in all manufacturing establishments, warehouses or retail stores will not be accepted, and that in such places approved reinforced cord is to be used. In all such installations, where brass sockets are to be used, they must be the 2-8 inch socket, and the cord must be of such cross section that it will enter the socket bushing without cutting away any of the insulation on the cord. This will confine the use of ordinary flexible cord to other risks, such as private residences, churches, or locations where they will not be subjected to mechanical injury. Even in such places where the cords are long and subjected to injury, the new rule will not in any way strike out the requirements of the code. This rule has been adopted in many places in the United States, and in some cases the use of flexible cord is abolished altogether. Flexible cord has been recognized for a long time as a fire hazard, and the fact that the adoption of the rule has been approved by practically every supply house and electrical contractor in Toronto shows that the new move is wise. Before the adoption of this rule the opinions of the contractors were obtained. Contractors are now given ample time to prepare for the change.

Another good move is the enclosing of all direct current motors in approved galvanized iron enclosures. This also extends to the main line switches, fuses and starting boxes. Several fires have been traced directly of late to the absence of this precaution in the city, and it seems to be almost necessary to make fuses and other apparatus in connection with motor installation "fool-proof." It is a common thing to find one of the motor fuse holders filled with copper wire close to inflammable material. The enclosing of these fuses and other apparatus in galvanized iron boxes hinged from the top, which will consequently close from gravity, will reduce the danger from this practice to a minimum. This idea is also being adopted in many of the American cities. In some cases it is considered a necessity, and ratings on buildings are made accordingly. The question as to whether it will effect existing rates in Toronto is not yet decided, although the matter is under consideration.

Electric Window Blinds.

An excellent piece of mechanical ingenuity has been displayed by the Martel-Stewart Company, Limited, of Montreal, assisted by Mr. Benjamin Hughes, electrical engineer, in the installing of electric window shades in the new Physics Building of Toronto University. The window shades, ten in all, are put in use by the simple closing of a switch. To get this result 200 parts are required to each shade, with separate motor, reducing gears, and brakes. The whole made a most import contract and one which could only be carried out by a firm who were the best in their line. The advantage of electrically operated blinds are many. They do away with the necessity of cords and pulleys, which are forever getting out of order. They are great times savers in darkening or brightening rooms quickly. Once installed there is practically no cost to operate and little or no wear.

Intercommunication Telephones.

Mr. Walter Barr, jr., electrical expert and contractor, Toronto, is now making a specialty of intercommunication telephones, having recently installed a number of systems. Mr. Barr has been in business for ten years. He has recently removed from 848 1-2 to 758 Yonge street, where he has equipped an up-to-date show room and office. Mr. Barr gives his personal attention to all contracts. He does not confine his work to telephone equipments, however, as he points with pride to the electrical equipment of the Goderich elevator, which was installed and supervised by him and which he regards as one of the most interesting examples of conduit work in Canada.

Sparks.

The town council of Pincher Creek, Alta., are discussing the advisability of installing a municipal lighting plant.

The electric light plant at Leamington, Ont., is to be extended by the new owner, J. R. Gordon, of Sudbury, Ont.

H. Windebank, Mission City, B.C., has been granted rights to develop power at Silver Creek for an electric lighting system.

The Central Electric Company, Portage la Prairie, Man., propose to spend from $25,000 to $40,000 in a new building and in enlarging their plant.

The newly formed Saskatchewan Power Company, Saskatoon, Sask., capitalized at $1,000,000, are applying for incorporation to develop power on the Saskatchewan river.

The Iron Range Railroad & Development Company, Fort William, are seeking incorporation for the purpose of building a telephone system. J. F. Swinburne is interested.

A recommendation has been submitted to the city council of Victoria, B.C., by the fire wardens, calling for the installation of two electric pumps of 400,000 gallons capacity.

The West Shore Electric Railway will build from Grand Bend to London, Ont., and other points. They are now applying for an act to empower them to undertake construction.

Work will shortly commence at Nelson, B.C., on the extension of the municipal power plant at Bonnington Falls. Cecil B. Smith, of the Hydro-Electric Commission, is the engineer.

A rural telephone company has been organized at Mallorytown, Ont., where they will install a central office and build to McIntosh Mills, Caintown, Jamestown and Lyn. F. H. Mallory is secretary.

Among recent concerns to secure incorporation are the Trinidad De Cuba Light & Power Company, Limited, Belleville, Ont., capitalized at $100,000. The incorporators include E. G. Sills, O. A. Marshall, James Little and J. J. Flint, all of Belleville, Ont.

Managing Director Buntzen of the British Columbia Electric Street Railroad Company state no time will be lost in construction on the electric line between Vancouver and Chilliwack, and it is expected work will be finished and the line in operation before 1910.

It is now definitely stated that the Imperial Locomotive Works, Limited, will commence operations this spring at Lachine, Que. Col. L. Edye, of the Trust & Loan Company of Canada, is authority for the statement that $2,250,000 will be expended on the plant alone.

The British-Canadian Smelters, Limited, of Toronto, have decided to locate their large plant at Chippawa, Ont. The company will put up a plant for smelting and refining and employ five hundred men. Negotiations are under way for securing power from the Hydro-Electric Commission.

It is reported that the Walsh Holyoke Steam Boiler Works, of Holyoke, Mass., have secured the contract to furnish and install a steel penstock with its branches for the electric power station of the Newfoundland Development Company, at Grand Forks, Newfoundland, estimated cost $210,000.

Application will be made for a charter by a company who propose to construct an electric belt line from the city of Ottawa, to run through Carelton, Russell, Dundas, Brockville and Prescott, making a complete belt line of some two hundred miles. Mayor Cossitt of Brockville is stated to be interested.

The Prince Albert, Sask., city council have received a report from C. H. Mitchell, C.E., Toronto, upon the proposed development of power on the Saskatchewan river, and it is practically certain that the project will be carried through. The cost of developing 10,000 horse-power would be $350,000.

The North Midland Railway Company have obtained a two year extension from the Legislature, but the provisions call for an expenditure of $150,000 within the next two years and the completion of the line to Stratford and north into Huron within three years. The line from London to Stratford via St. Mary's will cost $800,000. The company hope to place their bonds this year.

It is estimated that it will cost $30,000 to place the fire alarm wires in the conduits built by the Manitoba Government in the city of Winnipeg. This includes the cost of the cables and ornamental posts to support the fire alarm boxes as well as the expense of connecting the boxes with the manholes. The question of ordering all overhead wires underground is being considered by the city council.

An agreement has been reached between Port Arthur and Fort William for the purchase of the municipal street railway system operating in the two towns. Fort William gets that portion of the system running in that city at a price to be agreed upon by arbitration. Port Arthur is to furnish the power for the present system for five years, providing power cannot be purchased elsewhere cheaper. If one city doubles the tracks the other must do the same.

The following figures have been prepared by City Engineer Keeley of Edmonton, Alta., in connection with the proposed electric light plant for that city: One 700 kilowatt gas engine and producer generating unit, $92,350; one exciter unit, $6,500; switchboard and wiring, piping, oiling system, erecting machinery and cost of foundation, $16,970; building, 75 by 112 feet, of brick and concrete, $16,970; incidentals, $7,210; total cost of plant, $140,000.

The legislature of Nova Scotia gave power last year to the towns of both Wolfville and Kentville to take over existing electric plants and operate municipal plants. There have hitherto been some difficulties in the way of the town of Wolfville operating under their legislation. These have now been removed and the town has secured J. J. Ritchie, of Halifax, as their representative and the company have taken P. S. Archibald, C.E., of Moncton, to arbitrate the value.

The organization of the Ontario West Shore Electric Railway Company is now complete. Plans of the route to Kincardine have been compelted, and a special meeting of the shareholders will be held to give the directors power to enter into contracts for the construction of the Goderich portion of the railway and also to give the directors time to issue bonds or debentures of the company to the extent of $15,000 per mile of the track. It is expected that the work of construction will commence before May 1st. H. J. A. McEwan, of Goderich, is secretary.

American Telephone and Telegraph Annual Report.

The annual report of the directors of the American Telephone & Telegraph Company gives the results of the business for the year 1907, as follows: Profits, $23,-479,290.10; interest, $7,209,902.16; balance, $16,269,-387.94; dividends paid, $10,943,644; carried to reserve, $3,500,000; carried to surplus, $1,825 743.94.

The following were the corresponding figures for the year 1906: Profits, $17,857,687.37; interest, $4,886,-750.61; balance, $12,970,936.76; dividends paid, $10,-195,233.50; carried to reserve, $1,773,736.62; carried to surplus, $1,001,996.64.

The number of subscribers' stations at the end of the year operated directly by the associated companies which constitute the system in the United States was 3,035,533, an increase of 308,244. In addition to this number there were 755,316 exchange and toll stations connected to the system by toll and long distance lines, but operated by local, co-operative and rural independent companies or associations having sub-license or connection contracts. Adding also the company's telephones employed for private line purposes, there was a total of 3,839,000 stations connected to the Bell system as against 3,070,660 stations at the close of the previous year, an increase of 768,340 stations.

The total mileage of wire in use for exchange and toll service was 8,610,592 miles, of which 1,141,687 were added during the year. These figures do not include the mileage of wire operated by sub-licenses.

Including the traffic over the long distance lines, but excluding sub-licenses, the daily average of toll connections was about 494,000, and of exchange connections about 18,139,000, as against corresponding figures in 1906 of 462,000 and 16,478,000; the total daily average for 1907 reaching 18,624,000, or at the rate of about 5,997,000,000 per year.

In the course of an article on "International Exhibitions," the "Electrical Review" of London, Eng., proposes the formation of an association of exhibitors and others for the British Isles and all the colonies and dependencies. The coming exhibition at Shepherd's Bush provides a good starting point for such a plan. All parts of the Empire are to be represented, as well as foreign countries.

William Ross, an employee of the West Kootenay Power & Light Company, Nelson, B.C., was instantly killed last month by touching a live wire at the switchboard, while showing some visitors over the plant.

The Boston-Premier Gold Company, near Lillooet on the Fraser river, have placed an order with the Vancouver branch of the Allis-Chalmers-Bullock Company, Limited, for a considerable amount of concentrating machinery.

The Taylor Mill Company of Victoria, B.C., in order to meet with their increased business have recently installed a 40 horse-power 2,200 volt 850 r.p.m. 3-phase 60- cycle induction motor complete. The order was given to Allis-Chalmers-Bullock, Limited, of Vancouver.

The Tyee Copper Company, Ladysmith, B.C., who have found it necessary to double their smelter capacity, have placed an order with the Vancouver office of the Allis-Chalmers-Bullock Company, Limited, for a large copper blast furnace, together with a Connersville blower complete, also a 12 inch and 24 inch by 30 inch cross compound Corliss engine direct connected to a 100 kw. 150 r.p.m. 240 d. c. generator. The order also included a number of large electric motors, etc.

Application has been made to the Ontario Government for a charter incorporating the Lorne Power Company, which desires to establish its base of operations at Wabageshik Falls. Authority is sought also for a railway operated by steam or electricity from the falls to the township of Denison.

Sparks.

The 25th annual convention of the American Institute of Electrical Engineers will be held at Atlantic City, New Jersey, from June 29 to July 2.

Hamilton City Council decided by a close vote, the mayor's casting vote being necessary, to advertise for a city engineer and to retain Engineer Barrow as consulting engineer.

The mills of the Canada Colored Cotton Company have been closed down for two weeks for the purpose of installing electrical machinery. About 300 people are out of work in consequence.

It is reported that the St. Lawrence Power Company's plant at Cornwall, Ont., has been taken over by a syndicate, and that plans for extensions, involving some $3,000,000, have been submitted to the International Waterways Commission. Geo. C. Foster, of Montreal, is stated to be the president of the new concern.

Dr. James Douglas, of New York, has subscribed $10,000 towards an endowment which the School of Mining, affiliated with Queen's University, has lately undertaken to raise. Dr. Douglass is an eminent bridge builder, who some years ago was made a Doctor of Laws by Queen's.

Wingham, Ontario, has decided by a vote of 231 to 176, against placing the electric lighting plant under the management of three commissioners. The plant has been owned by the town for the last four years and has been managed by the executive committee of the town council. The commissioners, who had been elected by acclamation, will not take office.

The Dominion Railway Commissioners held their first sitting since the appointment of the new chairman, Hon. Judge Mabee, on March 31, at Ottawa. After looking over the work to be done it was found that in only three of the cases would there be any question as to the necessity for a rehearing. These are the Bell Telephone case, the Winnipeg and Duluth coal rates case, and the C. P. R. traffic case.

The use of electric motors for driving all kinds of factory machinery is increasing at a rapid rate. Steel plants in particular are furnishing themselves with this means of power. The Saucon plant of the Bethlehem Steel Company, Pa., was probably the first to be designed and constructed with a view to using electrical drive wherever possible. The screw-downs, reserving tables, transfer tables, shifters, saws, and straighteners are all operated directly by Crocker-Wheeler motors. In fact all operations except the driving of the rolls, where steam engines are used, and heavy shearing, requiring enormous pressure, where hydraulic power is employed, are carried on by means of electrical drive.

CANADIAN
ELECTRICAL NEWS
& ENGINEERING JOURNAL

PUBLISHED ON THE FIFTH OF EVERY MONTH BY
HUGH C. MacLEAN, LIMITED,
TORONTO, CANADA.

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362
MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative
WINNIPEG - - - - - - - Telephone 224. 330 Smith St.
ROLAND F. HILL, Representative
VANCOUVER - - - Telephone 2248. 615 Hastings St.
GEO. A. GALL, Representative

ADVERTISEMENTS.

Advertising rates sent promptly on application Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.

The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

The Prepayment Meter.

It is a rather curious fact that in spite of the continued increase in the number of prepayment gas meters installed in Canada, the prepayment electric form has not met with anything like corresponding favor. This is due in all probability to a combination of two main points, namely, that the price is very much higher than that of the ordinary form, and that the prepayment instrument is more or less complicated as compared with the usual type. Besides these, there is probably a third reason at work, though doubtless it is not as pronounced as the other two, in the fact that in Canada there is not as yet that flat-dwelling frequent-moving population which in the States forms one of the chief reasons for the existence and use of prepayment meters.

Due to the fact that gas services are always underground, and that the meter is therefore almost invariably placed in the cellar or some other equally inconspicuous location, gas meters have always been of very much larger dimensions than are considered permissible for the electric form. These increased dimensions have naturally resulted in a corresponding increase in the size and strength of the parts, in view of which it has been a comparatively easy matter to add the extra equipment involved by the prepayment form. On the other hand, the electric meter is nearly always placed conspicuously, in view of which the demand has constantly been for one of smaller and smaller dimensions. Naturally the torque, as compared with that of a gas meter, must be very small, this in turn requiring that all the parts be very light and very accurately made. From this low torque it also necessarily follows that the complete instrument is fairly complex, as results which are attained in the prepayment gas meter by pure brute strength can be reached in the electric form by nothing but extra parts that have to be put into very little more space than is allotted to the regular type. Hence the greatly increased cost of the prepayment electric over the usual design, a percentage that is very much greater than than obtaining in gas meter practice, and in this we find one of the great reasons why prepayment electric meters are not more commonly used.

On the other hand, it is altogether probable that the present designs, which have been on the market for some considerable time in almost their exact original forms, will be materially simplified and cheapened as time goes on, which will doubtless mean that their use will be somewhat extended. This in turn will of itself also decrease the cost, as is always the case with an increased production. In view of this it is not unlikely that the prepayment electric meter will, after no great while, come much more to the front, especially as every company must naturally find, with the growth of its connections, an ever increasing number of those tenants that move in the night.

The Element of Light and its Application.

The use of light, either natural or artificial, is universal throughout the world. Further, the two main sources from which central stations draw their revenue are power and light, in fact, in a large number of cases, light alone. Notwithstanding these facts comparatively little though is given to its proper application, and to the many engineering points involved in order that the consumer may get the best results for the least expenditure, both for fittings and for energy. As a consequence of these conditions, we find an effort now being made to improve matters through the medium of the illuminating engineer, an expert in a branch of electrical engineering which has only recently been recognized at its true value.

Light is generally defined as that form of energy capable of affecting the optic nerve, though of course produces other effects besides vision, witness for instance its action upon a photographic plate. Speaking technically, the word as usually mean to indicate the source of light, though it is often used to indicate the device itself, as an arc light, besides which it covers in other cases the effect, for instance, when we speak of seeing light. It is now generally conceded that light is due to wave motions in that substance surrounding the earth which scientists call ether, in this way being very similar to sound, which is the result of, and is transmitted by, wave motions in the air. Light waves are very much more rapid than sound waves, the former moving at the rate of some 140,000 miles per second, as opposed to about 1-3 of a mile per second for the latter, hence the familiar phenomenon of seeing the steam from the whistle of an approaching locomotive some appreciable time before you hear it. Both sound and light waves vary over a large range of vibration, in each some vibrations being too slow and some too fast to produce visual or audible effects. Within their respective ranges to which the senses of the human body are susceptible the different number of vibrations produce varying colors in the one case and sounds of different pitch in the other. The slowest light waves produce the effect of dark red, the fastest pale violet, be-

tween them lying orange, yellow, green, blue and indigo. This table or division of any composite color or light into its primary colors is called the spectrum of that light, the foregoing colors, including of course the red at one end and the violet at the other, being the spectrum of sunlight or ordinary daylight, and hence being known as the solar spectrum. Rays of light that come from vibrations slower than those producing the red rays are known as infra-red, while those of higher frequency than violet are styled ultra-violet. The spectrums of different light sources vary from each other and from that of sunlight, for instance, enclosed arc lamps, especially the 220 volt class, tend to produce more blue and violet rays than do the open ones, while the majority of the mercury vapor lamps go still further, being almost entirely deficient in red and yellow, though rich in blues, violets, and ultra-violets. These are of course both most undesirable features, as it is generally considered that those artificial lights which have a spectrum nearest to that of sunlight (ordinary daylight) are the most desirable, in that this latter is naturally the light by which the human eye can best make comparisons.

Light is always accompanied by heat, and as heat is the only way we know of by which we can obtain artificial light, the problem of producing it naturally resolves itself into one of turning a given amount of energy into as little heat and as much light as possible. That the problem is a real one, and that there is every incentive for the present struggle to improve both incandescent and arc lamps, will be instantly conceded when we remember that the present efficiency of these devices does not exceed 5 per cent. to 7 pr cnt., if it be as high. Higher efficiency, other things being equal, is attained by raising the temperature of the light source, but this on the other hand means shortened life, so that the most satisfactory point at which to operate is always a matter of judgment and compromise. These higher efficiencies, due as they are to higher temperatures, always produce whiter light, that is as long as you keep the material the same, as witness the superior quality of the light from a 2½ watt incandescent lamp as compared with that from one consumping 4 watts per candle. A further illustration of the same phenomenon is afforded by the familiar blue rays emitted by the incandescent lamp when forced to an extreme point, the rate of vibration then having passed beyond the yellow and white to that which begins to produce blue.

Besides the question of temperature, there is another factor which materially affects efficiency, namely, that different bodies have varying powers of radiating light, or are of different light emissivity, even when heated to the same temperature. This is shown very clearly by the familiar fact that a black body absorbs and holds light, that is, does not reflect it and send it out again, as does one that is white. This principle is the one that was made use of in designing those higher efficiency lamps such as the limelight, Welsbach, flaming arc, etc., and now forms the basis of the efforts being made to perfect the vapor lamps, gases emitting light much more efficiently than a solid. The problem of these latter devices has really been solved, as far as the production of light is concerned, so that there remains now only the question of its quality, mercury, the vapor mostly in use, being far too prolific in ultra-violet rays, while at the same time lacking the red. The incentive, however, is very great, so that it will doubtless be but a comparatively short time before our standard arc lamps will be much more efficient than those now in use, just the same as the metallic filament incandescents are on the eve of replacing the old and well-tried carbon type.

Is it Worth While? Is it worth while to gather once a year with those who, because they are facing much the same situations as confront you daily, have undoubtedly a fund of valuable knowledge pertaining thereto, which is open property only at such a meeting? Is it worth while taking the trouble to impart some of your particular information in return? Is it worth while getting the benefit of combination in connection with such questions as insurance, legislation, lighting contracts, both private and municipal, the making and the enforcing of proper wiring rules, etc., etc., all of which are matters that can be handled to advantage only by a proper trade Association? In short, do you want to get out of your groove and become active in a campaign for the betterment of the central station industry? If so, join the Canadian Electrical Association, and when doing so make up your mind that your joining is going to be more than the mere paying of a fee.

The annual convention is but little more than a month away. Surely, if you have not already decided to go, that month will give you sufficient time in which to make the necessary arrangements for getting away. The benefits to be derived from participating in the convention are many and varied. Make up your mind that you will be one of the participants, and then turn round and see what you can do to get someone else, whom you know should be there, to attend with you.

Canadian Eleectrical Association Convention.

The Eighteenth Annual Convention of the Canadian Electrical Association will be held in Toronto, Wednesday, Thursday and Friday, June 10, 11 and 12 next. In selecting a place for this Convention the Managing Committee considered a number of locations and finally decided upon Toronto as the most suitable place for this year's meeting.

The local arrangements are in the hands of the following committee: Messrs. R. G. Black (Chairman), J. J. Wright, W. N. Ryerson, W. A. Bucke, J. A. Kammerer, H. A. Moore, H. H. Macrae, W. G. Chace, T. F. Dryden, T. J. Lynch, W. H. Eisenbeis, C. H. Mitchell, W. B. Boyd, R. J. Clark and G. K. Hyde. The Committee on Papers consists of Messrs. R. G. Black and W. N. Ryerson.

In arranging the program, the Papers Committee considered the whole electrical situation from both a commercial and political standpoint, being guided by the fact that Niagara power seems destined to be distributed throughout a large area of the Province of Ontario. Papers on the following subjects have been promised: How to Increase the Station Load; Loss and Unaccounted for Current; Various Electrical Power Plants by European Designers (illustrated); Various Distributing Systems Adaptable to Cities and Towns; Power Rates and Factors which Influence Them; Regulation of Electric Currents or Circuits; Grounding of Transformer Secondaries; Long Distance Transmission by Means of Direct Current; Electrical Plant Earnings per Capita; Electrical Franchises, Their Legal Status and Basis of Valuation; Large Power Plants of America (illustrated).

There will also be a legal paper on Contracts, with special reference to the sale and purchase of power and the drawing up of specifications and purchase of machinery.

The Question Box will shortly be ready for printing, and anyone willing to furnish answers to questions should forward them at once to the Managing Editor, Mr. A. A. Dion, Ottawa.

Municipalities' Power Contract.

Representatives of the Western Municipalities' Niagara Power Union, to the number of fourteen, recently endorsed the Hydro-Electric Power Commission's proposed contract. They passed the following resolution: "That this meeting have heard the statements of the Power Commission as to the contract for the supply of power at Niagara Falls, and as to the proposed transmission line with much satisfaction, and have partly considered the agreement with the Ontario Power Company, and the draft agreement between the Commission and the municipalities, and that this meeting fully approves the draft agreement as far as considered." It was also decided that the solicitors of the various municipalities should confer with Mr. Lobb and Mr. T. G. Meredith, on behalf of the municipalities, at an early date, in reference to the contracts. These conferences have been in progress and will be continued until definite decisions are reached regarding each municipality.

The prices set forth in the contract are $9.40 for power at 12,000 volts, until 25,000 horse-power or more in all are taken, then $9. The sum of $10.40 for power at 60,000 volts, until 25,000 horse-power or more in all is taken, and then $10. If power is taken at a higher voltage than those named above, the price is to be fixed by arbitration. The estimated maximum cost of power ready for distribution in a municipality is $18 per horse-power.

The Commission will agree, according to the contract, to construct a transmission line for power at approximately 25 cycle per second frequency, and on three months' notice to supply power in blocks up to a total of 30,000 h.p. On a nine months' notice they will supply power up to a total of 100,000 h.p. The corporations will agree to pay for power at the rate agreed upon and 4 per cent. on the capital expended for construction, together with an annual sum for a thirty years' sinking fund, the line loss, operation, maintenance, repair, renewal and insurance costs. Unless determined under special conditions, the contract is to remain in force for 40 years.

Pending the signing of the contracts by the municipalities the Hydro-Electric Power Commission's engineers have prepared specifications and estimates of the cost of transmitting power to the various towns and cities which have passed by-laws. This has been done to save time, in view of the fact that the agreement with the Ontario Power Company may be terminated in 22 months if power is not taken. The estimates are based on the plan for the erection of a transmission line by the Government with a capacity of 80,000 horse-power at high voltage. This amount of high tension power is equal to double the quantity of low tension power. Hon. Mr. Beck estimates that the lines and transformer stations for the whole system of transmission to Toronto and the western municipalities can be built for between $3,400,000 and $3,500,000.

Ontario Power Commission's Contract.

The contract between the Hydro-Electric Commission and the Ontario Power Company for the supply of power is incorporated in a bill recently passed by the Legislature. The contract is to become binding on the Commission on passage of an Order-in-Council by the Government. The company will commence to deliver 8,000 horse-power of electricity to the Commission at the expiration of 90 days' notice. At the expiration of three months' notice it will deliver in blocks of 1,000 horse-power energy up to 30,000 horse-power, and on nine months' notice electricity up to 100,000 horse-power. The Commission agrees to take power exclusively from the company up to 30,000 horse-power, and also one-half of the amount of power required by the Commission up to 110,000 horse-power, after which the Commission may take electricity from other sources. The company, on its part, will not deliver power to any person that it is intended shall be supplied by the Commission. The Commission agrees that it will not supply power of less than 60,000 volts at a price less than the price provided in the contract, with the cost of transforming added thereto, in the territory supplied by the transmission lines of the company.

The Commission must pay for three-fourths of the power ordered, whether it takes it or not, at the prices already announced.

The Commission agrees to pay the company at the rate of $9.40 per horse-power per annum for power at 12,000 volts, and at the rate of $10.40 per horse-power per annum for power at 60,000 volts, and when the amount reserved and held ready for delivery upon the order of the Commission is in all 25,000 horse-power or more, payment shall be made at the rate of $9 per horse-power per annum for power at 12,000 volts, and at the rate of $10 per horse-power per annum for power at 60,000 volts. If power is taken at a higher voltage than 60,000 volts the price shall be determined by arbitration at the expense of the Commission.

The agreement is to remain in force for ten years, and is subject to renewal for ten-year periods. It is not, in any event, to go beyond 1950. The company agrees not to exercise its right to cancel its charter during the continuance of the agreement. If, after all reasonable diligence, the Commission is not within eighteen months able to start to take power, the company shall have the right to cancel the contract. The point of delivery shall be the property line between the company's distributing station and the right of way of the Michigan Central Railway at Niagara Falls, Ontario.

Penalty clauses are inserted providing for a reduction in case of an interruption of the service. In case any municipalitiy or its customers for power shall suffer damages, the Commission shall be entitled to commence proceedings for damages. Provision is made for arbitration of any disputes which may arise between the parties as to the performance of the terms of the agreement.

If the quantity of power being taken by the Commission shall amount to sixty per cent. of the total development of the company and a complaint is made in writing that the company is continuously neglecting to fulfil its agreement, the Lieutenant-Governor-in-Council by order may, on reasonable terms, transfer the entire plant and property to the Hydro-Electric Power Commission.

The reports that Brantford would drop out of the Power Union of the Ontario Municipalities has been definitely denied by the City Council.

Mechanical Equipment of the Ottawa Mint

By A. H. W. Cleave.

Read before the Canadian Society of Civil Engineers.

The mechanical equipment of this branch of the Royal Mint was completed by the end of October last—the time occupied in the manufacture and installation of the necessary machinery having been just ten months.

Many machines in the coining department have been designed specially for the Ottawa Mint, and in these new devices have been adopted which are not to be found in other similar institutions. In addition to the machinery in that department, where the actual minting of money takes place, the following plants have also been installed:

(1) The electrical plant, for power distribution, for lighting, etc.

(2) The oil fuel plant, for storing and distributing the oil-fuel used throughout the various departments in the melting, annealing, and cupel furnaces, together with the fans and blowers for the same.

(3) The die-making plant, for sinking, turning, annealing, and hardening the dies used for coinage purposes.

(4) The plant for the boiler house and the machine, smith's and carpenter's shops, in which all running repairs are effected and small tools made.

(5) The plant for the assay department, where all the precious metals received into and issued from the Mint are analyzed; and in which experimental research work will be conducted.

To give a full and complete description of all the mechanical devices which have been installed throughout the Mint would make this paper unduly long. Each of the plants enumerated above will therefore be briefly dealt with in turn, in the order given; and then the coining department, which contains types of machines probably less commonly known than the rest, will be described more at length.

Electrical Plant.

Electrical Equipment.—The electricity used for power and lighting is supplied in the form of a two-phase, alternating current, and enters the building at a potential of 2,140 volts. It then passes through the transformers, of which there are three for power and three for light. In each case, one is a spare which can be put into circuit, on either phase, by operating the primary and secondary switches.

The transformers for power operate the motor of a motor generator set. They are single phase, step down, oil insulated, self cooled, for a circuit of 60 cycles. The primaries are wound for a potential of 2,140 volts, and the secondaries for a potential of 500 volts. Their normal full rating is 100 kilowatts each.

The transformers for light operate the electric light system of the building. They are similar to the transformers for power, but the secondaries are wound for a potential of 107-214 volts; while their normal full rating is 15 kilowatts. The primaries and secondaries of each transformer are provided with binding posts, so that any one of them may be connected or disconnected without soldering to leads, or cutting wires.

The motor generator set for transforming the current to operate the motors throughout the Mint consists of an alternating current motor and continuous current generator. The motor is of the two-phase, alternating current, induction type, operating from the transformers at a potential of 500 volts; its normal full rating being 225 h.p., at a speed of about 800 revolutions per minute. The generator is multi-polar, compound wound, continuous current, operating at a potential of 225 volts; its normal full rating being 150 kilowatts. The motor and generator are on one bed plate, and supplied with auto starter for the motor, and field rheostat for the generator.

There are 32 compound wound, continuous current motors in use, ranging in power from 1 1-4 h.p. to 30 h.p., all operated at a potential of 220 volts.

The wiring for the motors is of the parallel two-wire system, the wires being carried in steel conduits. The wiring for the lighting is of the interior conduit system; all the main circuits being of three wires, and the branch circuits of two wires. There are 415, 3.5 watt 16 c.p. 102 volt incandescent lamps, and 17 arc lamps. The latter are of the enclosed type for multiple circuits, adjusted for 7 amperes and 107 volts, alternating current. The buildings are wired for electric clocks, bells, and telephones, which are in use throughout the Mint.

Oil-Fuel Plant.

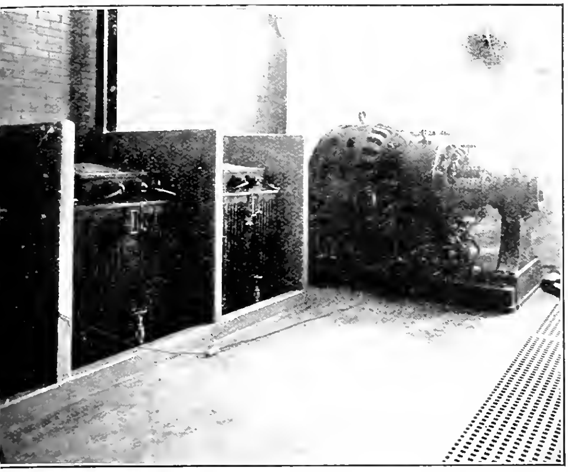
Oil-Fuel Equipment.—The fuel used for melting and annealing purposes, and for the cupel furnaces in the assay department, is crude oil; its specific gravity being .850. The plant for storing, distributing and burning this fuel consists of: Four storage tanks (each of 2,000 gallons capacity), two rotary pumps for distributing the oil throughout the buildings, three pressure blowers, four melting furnaces for crucibles holding 90 pounds each, one strip annealing furnace, one blank annealing one die hardening furnace, and three cupel furnaces and two small melting furnaces for the assay department. In the melting and cupel furnaces an air blast is used in conjunction with the oil; while in the annealing furnaces and die hardening furnace dry steam is used, at a pressure of 60 pounds per square inch. The oil pumps are so arranged that the fuel is delivered to the furnaces at constant pressure. All oil pumped, but not used, is returned through a spring-loaded valve to the storage tanks.

The tanks are supported on concrete bearers, one at either end, and one at the centre of each tank—so that the air may circulate freely around them. The piping for these tanks is so arranged that each one may be filled or emptied separately. Each tank is also fitted with a return pipe from the pumps, and a vent pipe through which all fumes rising from the oil are lead to the roof of the building. The air for the blast used in the melting furnaces is drawn from the tank room, so that the air round the tanks is constantly changed.

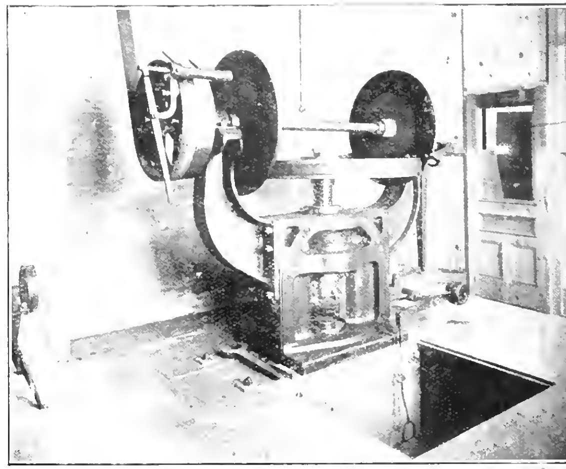
This fuel is found to be very economical, and excellent results have been obtained from all the furnaces. The heat can be regulated without difficulty, and, in the melting furnaces, either nickel or aluminium may readily be melted.

Die-Making Plant.

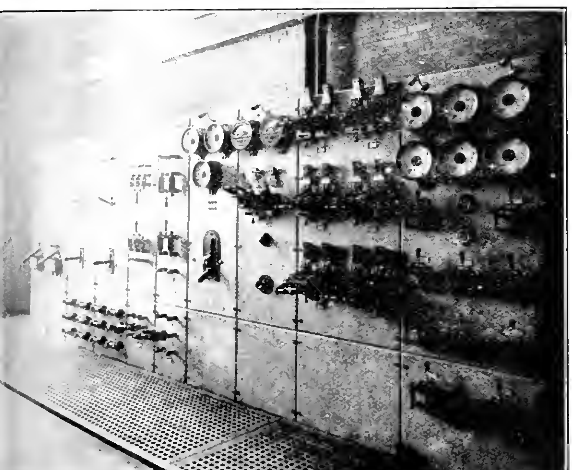
Die Department.—The machinery in this department consists of a die-sinking press, two die-turning lathes, and a die-hardening furnace. The press and lathes are driven by a motor through an overhead shaft. In the die press the blow is given by a heavy flywheel, 5 feet in diameter, which is keyed to a triple screw of 6 inches diameter. The flywheel is actuated by 2 rapidly revolving discs which can be brought into contact with its leather-covered rim. One friction disc raises, and the other depresses the screw. The operator works the press by depressing a stirrup rod with his right foot. This action brings one of the friction discs into contact with the rim of the flywheel, and thus the required blow is given to the die. On the operator withdrawing his foot, a balance weight raises the stirrup, the other friction



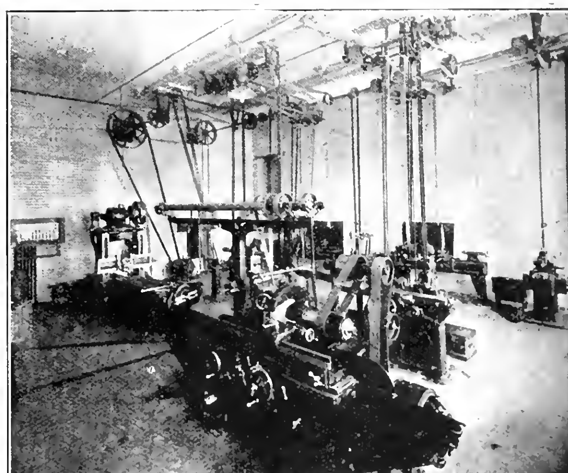
Motor-generator Set and Power Transformer.



Die Sinking Press in Die Department.



Main Switch Board in Power Room.



Machine Shop.

disc comes into operation, and the screw is raised. After the blow has been delivered, the height to which the screw shall rise is regualted by a brake adjustment; and having reached that height, it remains there until the stirrup is again depressed. In this press a blow may be given varying from a few pounds to about forty tons.

Each coinage die requires three blows from the punch before the impression received is sufficiently sharp in all its details. After each of the first two blows the die is annealed in the die furnace. After the third blow it is turned to the correct size, and then hardened and tempered; after which it is ready for use in the coining press. It is usual for a pair of dies to strike about 80,000 pieces before they are unfitted for further use.

Machine Shops.

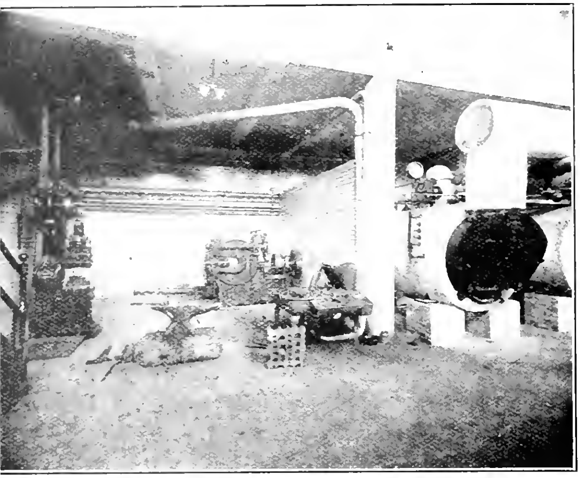
Repair Shops, etc.—In the machine shop the following tools have been installed:

One 14-inch by 72-inch Norton roll grinding machine.
One Brown & Sharpe No. 13 universal grinding machine.
One Brown & Sharpe No. 2 milling machine.
One Bertram planing machine.
One Barnes 21-inch drilling machine.
One sensitive drill.
One 16-inch gap lathe.
One 14-inch Pratt and Whitney lathe.
One shaping machine.
One polishing spindle.

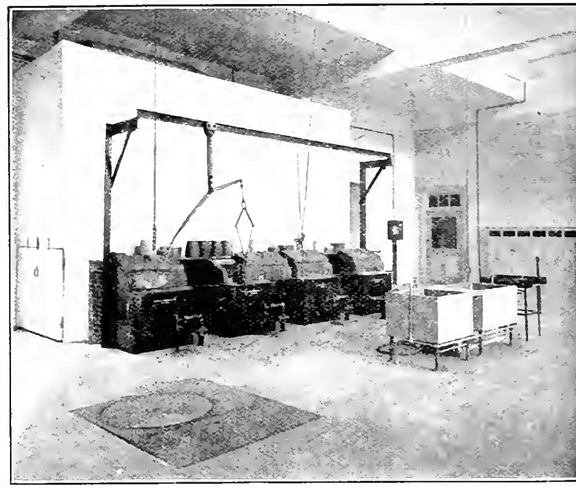
In addition to the above, fitters' benches, grindstone, power hacksaw, etc., have been installed.

The roll grinder and the planer are driven by their own motors, while the other machines are grouped.

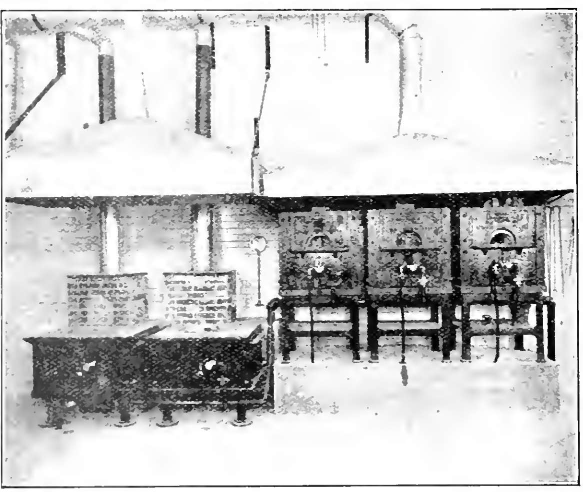
An elevator is situated in one corner of the shop, communicating with the smith's shop, which is in the basement next to the boiler room.



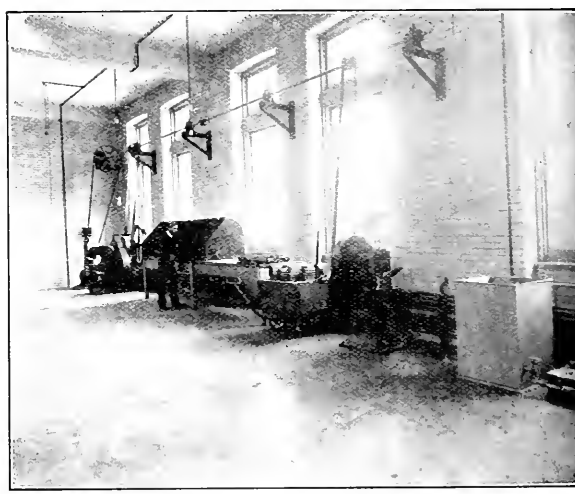
BOILER HOUSE AND SMITH'S SHOP.



MELTING FURNCES, CONDENSING CHAMBER, AND TANKS.



CUPEL AND MELTING FURNACES IN ASSAY DEPARTMENT.



SHEARING MACHINE, ROTARY FILES AND ASSAY CUTTER.

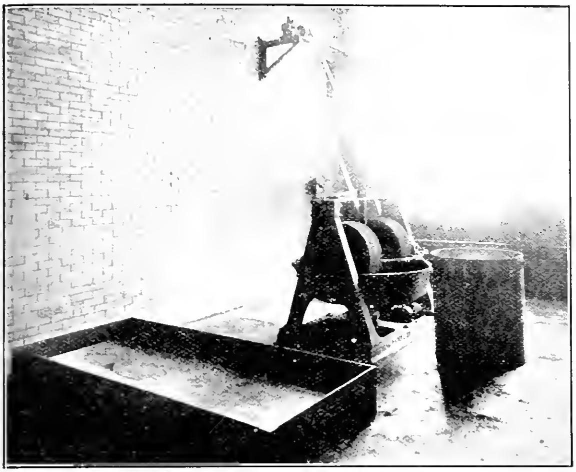
The smith's shop contains a Buffalo down draft forge, a Fairbanks 100-pound power hammer, shearing machine, etc.

The boiler room is equipped with two marine type multitubular boilers, which are used for heating the operative department, by steam, during the cold weather; for supplying hot water throughout the buildings; and for supplying steam to the annealing and die furnaces, and to the drying apparatus. Hard coal is used in these boilers, and a pressure of 80 pounds per square inch is maintained. The boilers are fitted with connections so that either, or both, may be used for any of the above services. The steam for heating the building, before entering that system, passes through a reducing valve, so that the pressure is reduced to 10 pounds per square inch. The returns from the heating system are lead to a hot well, and are returned to the boilers by a duplex feed pump. The boilers may also be fed by means of a Pemberthy injector, or direct from the mains, in case of necessity, and when the steam pressure is below 40 pounds per square inch.

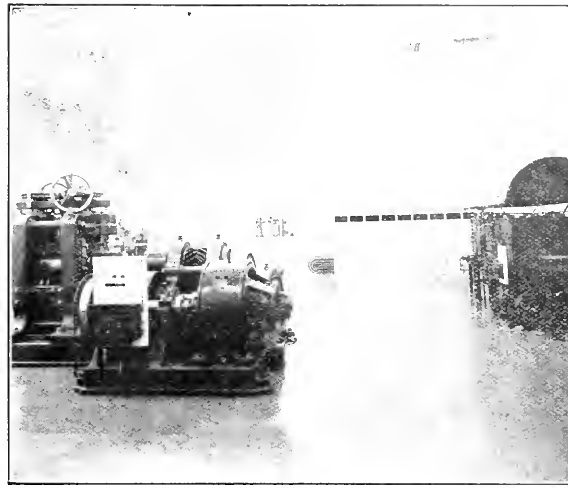
The carpenter's shop is in the basement, next to the smith's shop, and contains a variety saw, a 12-inch wood turning lathe, and a carpenter's bench. The saw and the lathe are driven from an overhead shaft by a motor, which also drives the shafting for the blacksmith's shop.

Assaying Plant.

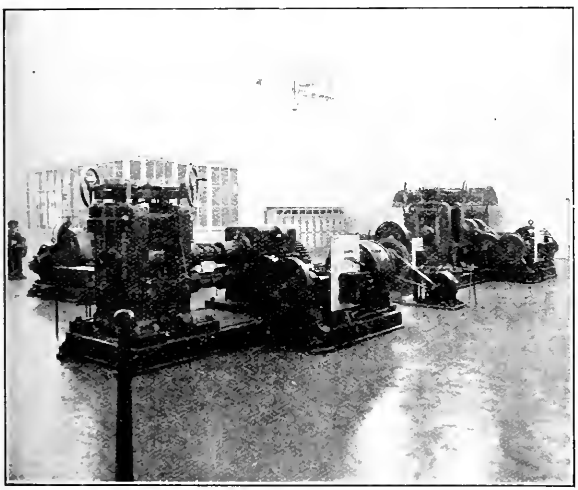
The Assay Department. This department is situated in the front building, and occupies three floors. In the basement the motors and blowers for the furnaces are installed, and here also are stored the acids, chemicals, etc. The furnace room is on the ground floor, and contains three cupel and two melting furnaces; all heated



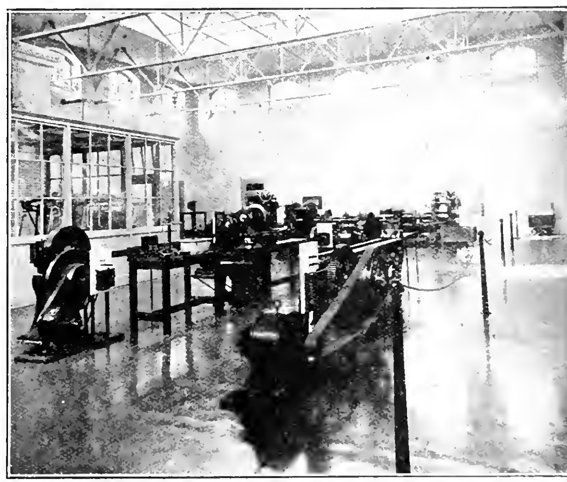
Mortar Mill for Recovery of Metal.



Breaking-down Mill and Fillet-annealing Furnace.



Rolling Mills. Fillet-annealing Furnace on Right.



General View of Rolling and Adjusting Room.

by oil-fuel in conjunction with an air blast. The second floor is occupied by the laboratory and scale rooms.

In this department is an elevator, communicating with all three floors, which may be used either for passengers or for the conveyance of apparatus, acids, etc., to the various rooms. Additional communication between the three floors has also been provided, in the form of a spiral stairway. Fume chambers have been installed in the laboratory and furnace room, together with the necessary chemical and physical apparatus for assay and experimental work.

The Coining Department.

For the purpose of describing the machines used in the actual processes of minting, it may perhaps prove interesting, and more intelligible, if the various operations through which the metals pass while being transformed from ingots into finished coins, are stated in order of sequence, and then are dealt with separately. A short description of each machine and the part it takes in the production of the coins will in each case be given. The operations are as follows: Melting, rolling, adjusting, cutting, marking, annealing, blanching and cleaning, coining, testing.

Melting.—The ingots (of a purity of 999 parts per 1,000, or over) are placed with the necessary alloy in the crucibles, and charged into the melting furnaces. There are four of these furnaces altogether, each one taking a No. 30-35 crucible (about 90-110 pounds of silver). Crude oil is used as fuel, in conjunction with an air blast. The oil (sp. gr. 32-34 B.) is delivered to the furnaces in very fine streams at a pressure of about 25 pounds per square inch, and is mixed with air from a low pressure blower (air blast about 10 ounces per

square inch). The flame does not play directly on the crucible, but first strikes a fire-brick, and is then deflected so as to travel round the crucible, and then to the flue.

These furnaces are very clean, economical and easy of manipulation. It is usual, in the case of silver, and starting with a cold furnace, for the first round to be ready for pouring one and a half hours after lighting up. After the first round has been poured the furnaces have become thoroughly warmed up, and the subsequent rounds are ready for pouring one hour after charging in. It will thus be seen that in an ordinary working day of eight hours metal can be poured six times from each furnace.

The flues are so arranged that the gases issuing from the furnaces enter a large condensing chamber, where they expand rapidly, and their velocity is reduced. In passing through these chambers the gases strike against baffle plates (the course taken by them being in the form of the letter S placed on its side), by means of which their velocity is still further reduced. Any fine particle of metal which may be carried by them from the furnaces are deposited on the baffle plate and sides of the chambers, and are thus prevented from being carried away through the chimney stack.

This treatment of the gases results in the saving of a considerable amount of metal, as is clearly shown in the annual report of the Director of the United States Mint. From this report it appears that, after six months' working, the value of the metals recovered from the condensing chambers attached to 13 furnaces was no less than $12,900.

After the metal has been melted, it is poured into cast iron moulds, forming bars about 24 inches long, 1-2 inch thick, and varying in width from 1 1-4 inches to 2 1-4 inches, according to the denomination of coin to be made. The newly-formed bars are removed from the moulds as soon as they have become solid, and plunged in a weak solution of sulphuric acid; after which they are washed and dried. They are then taken to the shearing machine and revolving files, where the spongy ends are removed, and the rough edges trimmed. They are then ready for the rolling mills.

The shearing machine is of the usual single-ended pattern, such as used in maheine shops, fitted with fast and losse pulleys, and driven from an overhead shaft.

There are two revolving files, each consisting of a headstock, with shaft, and single pulley between the bearings. On one end of the shaft, outside the bearing, is keyed a circular file of about 6 inches diameter and 6 inches long. These files are also driven from the same overhead shaft as the shearing machine, and revolve at 150 revolutions per minute. The bars from each crucible are kept separate from those from any other crucible, and are marked with distinctive letters and figures, so that their origin can be readily traced at any time. A small piece is cut from one end of the first and last bar from each crucible, and these pieces are forwarded to the assay department for testing purposes. The bars are not operated upon until the report from that department has been received stating that they are within the legal remedy as to fineness. All bars which are above or below the legal standard are re-melted with the necessary amount of alloy, or fine metal, to bring them within the remedy.

All the worn out crucibles, covers, etc., are ground to a fine powder in a mortar mill; the powder being washed, so as to recover any metal that may have been taken up during the process of melting.

The powder is washed twice, after which it is sold by public tender, the tendering firms being allowed to take samples beforehand.

The mortar mill used for reducing the worn-out crucibles, etc., is fitted with an under-driven revolving pan, five feet in diameter, has fast and loose pulleys, and is driven from an overhead shaft by a 5 h.p. motor. After the powder has been washed, it is dried in a steam heated drying pan, 8 feet long, 4 feet wide, and 10 inches deep. It is then thrown into bins, where it is stored until sold.

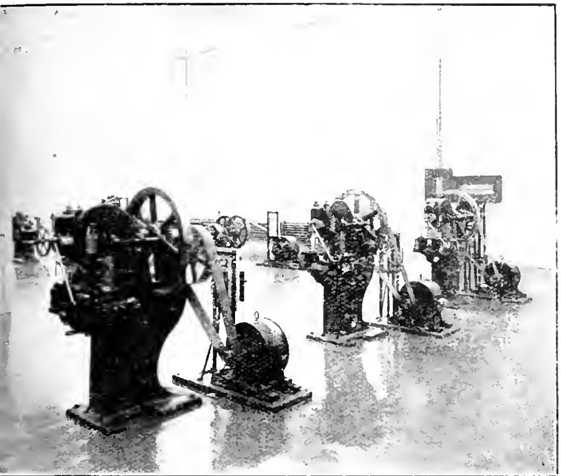
Rolling.—When designing these mills arrangements were made to provide for extremely accurate and very fine adjustments for the rolls, for all the driving mechanism to be kept above the floor level (the ground being rock, and very hard to excavate) and for economy of floor space.

Each mill is driven by its own motor, through gearing; the general arrangement being as follows: The motor, gearing, and roll housings are all on one bed plate, thus ensuring rigidity and perfect alignment. The first motion shaft carrying the driving pinion runs in its own bearings and, at one end, is connected with the motor through a flange coupling outside one of the bearings. The driving pinion is situated between these bearings, so that the motor is entirely free from any thrust. At the other end of this shaft, outside the other bearing, a small flywheel is keyed. The second motion shaft gears with the shaft driving the bottom roll, and this latter shaft gears through double helical gearing with the shaft which drives the top roll. The rolls are connected with the gearing by means of breaking spindles and muff couplings. The couplings are held up to their work by adjustable wood distance pieces.

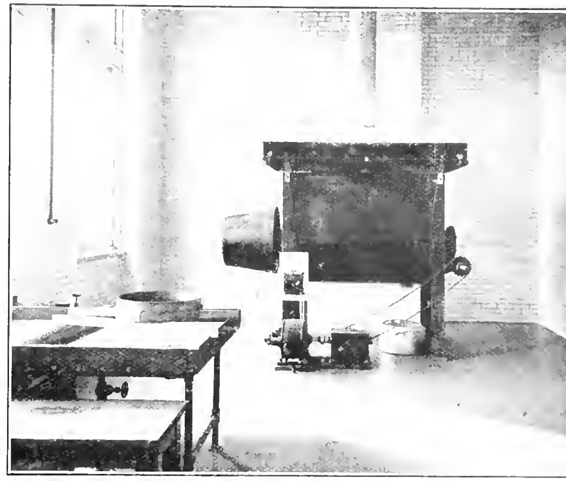
The motors run at 600 revolutions per minuite, and the rolls at from 40 revolutions per minute, for the breaking down mill, to 60 revolutions per minute for the finishing mill. The form of drive described above is found to be very convenient, and to absorb very little power.

The breaking down mill is driven by a 30 h.p. motor fitted with an overload release, which is set to cut out at 50 per cent. overload. The distance between the rolls is regulated by means of worms and worm wheels actuating large, single, square thread screws of 1-2 inch pitch. There are 50 teeth in each worm wheel. The worm shaft is divided in the centre, the halves being connected by means of a friction coupling, so that when it is necessary to "parallel" the rolls, one end only of the top roll may be moved at a time. This worm shaft is actuated by hand wheels at either end, one complete revolution of which closes or opens the rolls .01 inch. The hand and worm wheels are fitted with indicators and divided circles, so that adjustment of the rolls can be made as fine as .0005 inch. For ordinary rolling it is usual to work to .001 inch at this mill.

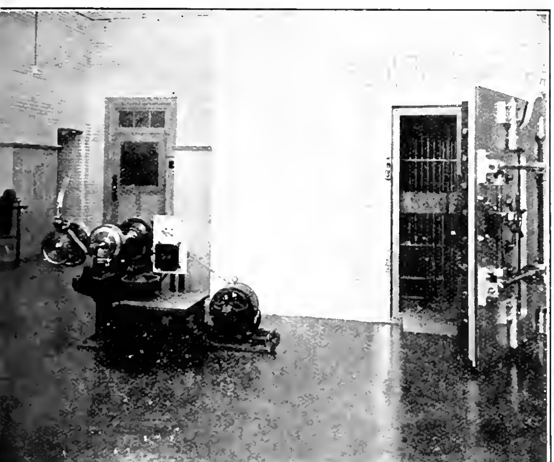
It has been found difficult, with the form of adjustment detailed above, to prevent the top roll from jumping when the bar which is being reduced first enters between the rolls. This jump may arise from the three following causes: Firstly, there may be slackness between the roll journals and bearings. Secondly, there may be looseness in the attachments between the bottoms of the big screws and the caps of the roll bearings. Thirdly, there may be wear between the big screws and the threads of the nuts in the roll housings. When it is remembered that the weight of the top roll with its brasses and adjusting gear amounts to about two tons, it can be readily imagined that signs of wear will soon become apparent between these nuts and screws. Vari-



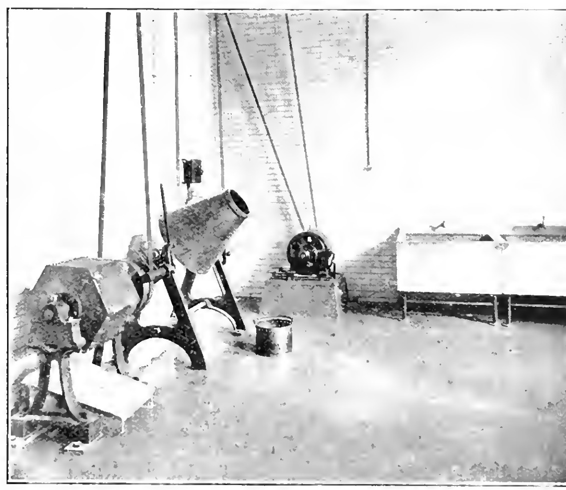
CUTTING-OUT MACHINES.



ROTARY BLANK-ANNEALING FURNACE AND SAWDUST-DRYING PLATE.



MARKING MACHINE AND STRONGHOLD DOOR.



TUMBLING BARREL, DRYING DRUM, AND WASHING TANKS.

ous devices have been tried with a view to prevent this jumping of the top roll; a common one being that of heavy weights, situated in a tunnel below the floor level, which act through levers and rods to counterbalance the weight of the top roll and gearing. This method, however, does not entirely overcome the difficulty. In order to avoid excavating for a tunnel, the following arrangement has in this case been adopted, and there is every reason to hope that it will be entirely successful in preventing the jump of the roll: The top of each roll housing has been extended on one side so as to form a hollow casing in which a powerful buffer spring is situated. Each spring is of sufficient strength to take, when half compressed, the entire weight of the top roll with its brasses and adjusting gear. When the top roll is depressed to within one inch of the bottom one, these springs come into full play, and thus keep the big screws which actuate the top roll in close contact with the upper side of the threads in the nuts. There is thus no weight on the bar that is being rolled other than the intentional pinch given to it through the gearing. This arrangement has been thoroughly tested and, up to the present, the top roll has shown no sign of jumping. The bars so rolled into "fillets" have been carefully gauged and found to be remarkably uniform throughout their entire length. The rolls in this mill are 14 inches in diameter and 16 inches in length, and are driven at 49 revolutions per minute.

The thinning mill is driven by a 20 h.p. motor in the same manner as the breaking down mill. The adjustment of the rolls is also the same, but the gearing, etc., is, of course, of somewhat lighter construction. The rolls in this mill are 12 inches in diameter and 14 inches in length, and are driven at 50 revolutions per minute.

The finishing mill is droven by a 10 h.p. motor in the same manner as the others; but the adjustment of the rolls is different. The distance between the rolls is varied by raising or lowering the bottom roll by means of long steel wedges, which are actuated by a hand wheel through gear wheels and fine screws. The hand and gear wheels are fitted with indicators and divided circles, so that adjustment of the rolls can be made as fine as .0002 inch. The rolls in this mill are 10 inches in diameter and 12 inches in length, and are driven at 60 revolutions per minute.

The bars from the melting department are first passed 10 or 12 times through the breaking down mill, after which they are annealed in the fillet annealing furnace. They are then passed 8 or 10 times through the thinning mill and 5 or 6 times through the finishing mill, when they should be the correct thickness for the coin that is to be made. For silver and bronze coins, rolling is sufficently accurate; but for gold, further treatment is necessary. This latter metal is very dense, having a specific gravity of about 19 as against about 10 for silver and about 9 for bronze. The variation allowed by law from a standard weight is also, in the case of gold coins, very small. For instance, the standard weight of a British sovereign is 123.274 grains, but the remedy allowance is only .2 grain. If the coin exceed this limit, by even so little as .01 grain, it is rejected, and re-melted. The remedy allowance on silver coins is much more generous, weight for weight; being between two and three times as great as for gold.

The fillet annealing furnace is heated by oil-fuel mixed with steam at 60 pounds pressure per square inch. The floor of the heating chamber is composed of three endless chains, travelling side by side, and driven by sprocket wheels situated at either end of the chamber. The speed at which the chains travel can be varied by means of a speed box attached to the driving motor; so that the time occupied by a fillet in passing through the furnace may be from 4 to 12 minutes. The fillets are laid flat on the travelling chain, 5 or 6 side by side, and as they emerge, pass through a sheet of water; so that they are cooled before they come into contact with the air. This arrangement prevents oxidation, and very little, if any, discoloration is noticeable.

Adjusting.—In the case of silver and bronze, the fillets pass from the finishing mill to the blank cutting machines; but, in the case of gold, as before stated, it is found that further adjustment is necessary. The gold fillets are accordingly taken to the draw-bench, where they are drawn betwen two fixed steel cylinders by means of a dog-clutch which engages with an endless chain. These cylinders are about 4 1-2 inches long and 3-4 inch in diameter; they are highly polished, and extremely hard, and the distance between them can be adjusted to .001 inch. By this means the small inequalities in the thickness of the fillets are regulated, and their variation from standard is reduced to a minimum. The fillets then pass to the blank-cutting machines.

Cutting.—There are three of these machines, each one driven by a separate motor, and capable of cutting blanks for all sizes of coins, at the rate of 300 per minute. The punches and beds for all the different denominations are interchangeable, so that little time is occupied in changing from one to another. Each machine is fitted with an automatic variable feed, which can be increased or decreased by multiples of .05 inch.

After the blanks have been cut from the fillets, the skeletons that are left (technically known as "scissel") are cut up into convenient lengths, and made up into bundles for re-melting.

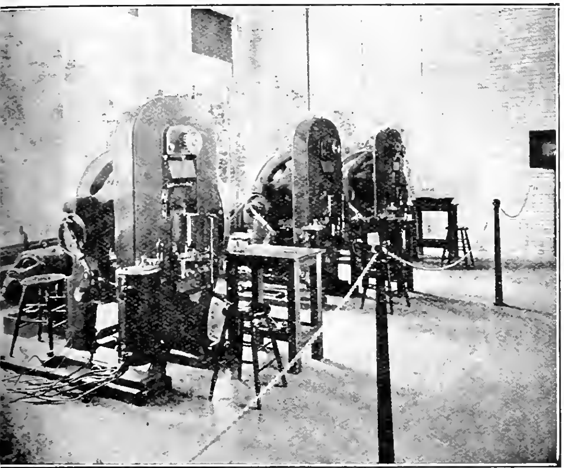
Marking.—The blanks are next taken to the marking machine, where raised edges are formed round their circumferences. These raised edges protect the impressions which will be given to them later in the coining presses, and thus prevent their being rapidly worn away. This machine is capable of marking 600 blanks per minute. The blanks pass between a circumferential groove, in a rapidly-revolving hard steel disc, and another groove, struck from the same radius, in a fixed hard steel block. The distance between the disc and the block can be varied, so that any size of blank may pass between them. The blanks are then annealed, and thoroughly cleaned.

Annealing. The blank annealing furnace is heated in the same manner as the one used for annealing the fillets; but the arrangements for passing the work through is different. The blanks are fed into the machine through a sheet iron hopper. This hopper is attached to, and revolve with a cost iron hollow cylinder, on the internal surface of which is cast a hollow thread of very coarse pitch. The blanks follow this thread, moving forward slowly as the cylinder revolves, until they fall through an opening which communicates with a shute leading into a vessel containing water. The flame surrounds the cylinder, which is kept at a red heat during the process of annealing. The time taken by the blanks in their passage through the furnace is regulated in the same manner as in the fillet annealing furnace. The blanks are cooled before they come into contact with the air, and oxidation is thus prevented.

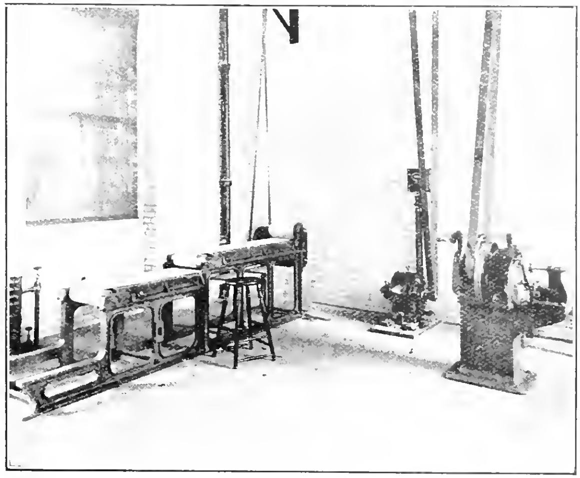
Blanching and Cleaning.—After having been annealed, the blanks are cleaned in a weak solution of sulphuric acid; washed and dried; they are then ready to receive the impression from the dies. The solution of sulphuric acid is contained in a copper tumbling barrel which revolves at about 40 revolution per minute, and is so designed that it can be tilted for filling and emptying. After treatment by the acid, the blanks are washed in tanks containing hot and cold water, and are then placed in the drying drum with beechwood sawdust. Beechwood is used for this purpose because it contains no resin, or other ingredient likely to discolor the blanks or make them adhere to one another. The drying drum is hexagonal in section, the sides made of hardwood, and the ends and attachments of brass. This drum revolves at about 25 revolutions per minute, and the blanks and sawdust remain in it for about ten minutes. They are then tipped into a circular sieve, and shaken over the hot plate. The mesh of the sieve is large enough to allow the sawdust to pass freely through the bottom, but small enough to retain the blanks. The hot plate consists of a flat sheet iron pan about 6 feet long, 4 feet wide, and with sides 6 inches high. It is supported on four iron legs, and stands about 3 feet 6 inches from the ground. Beneath the pan, and in close contact with it, is a steam coil, by means of which the sawdust is dried, and may be used over again.

Coining.—The coining presses, of which there are three, are of the type in which the pressure is given to the coins through levers and toggle joints. The hard steel knuckles of the toggle joints are of exceptionally large dimensions, so that coins can be struck at the rate of 100 per minute without any danger of them becoming overheated. Each press is driven by its own motor, and arranged so that the drive can be made either through a belt or gearing. The number of blows struck per minute can be varied from 30 to 100 by means of a 5-step controller.

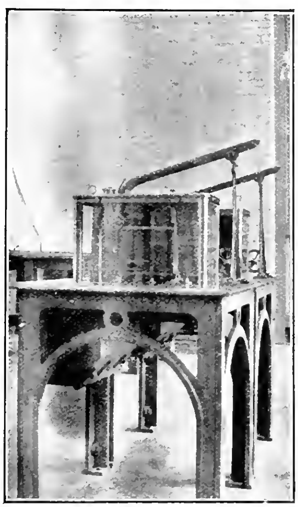
The top and bottom dies move up and down, the collar plate remaining stationary. The blanks are placed



COINING PRESSES.



OVERLOOKING AND DEFACING MACHINES.



AUTOMATIC WEIGHING MACHINE.

in the feed tube by the operator, in piles of about 30 They are fed to the dies, automatically, by steel feeding fingers, which take one blank at a time from the feed tube, and drop it into the collar, at the same time pushing the previously struck piece into the delivery tube.

Hitherto, when coining, it has frequently been the case that, for some reason or other, a blank has not been placed between the dies at the proper moment. This may occur through the feed tube being empty, or through a bent blank sticking in the tube. In every case the dies have come together ("clashed"), and have been rendered useless. It has been known in a large mint for as many as 12 dies to be "clashed" in one day; representing a cost of not less than $22, over and above the time taken in changing the dies. As a general rule a pair should be capagle of striking about 80,000 pieces before becoming unfit for further use. In order to prevent the possibility of "clashed" dies, a device has been adopted in these presses, by means of which the dies do not come together unless a blank has been placed between them. This device consists of a special clutch between the flywheel and the main shaft, which is actuated by an arrangement of levers connected with the feeding fingers. In the event of a blank not being fed to the dies, the clutch is released, and the column holding the top die is stopped instantly, at its highest point: the flywheel continuing to run idle on the main shaft. This attachment takes up no extra floor space, and is exceedingly neat and effective. By its means also, single strokes can be made by the press; a very convenient arrangement when setting a new pair of dies.

After the coins have been struck, they are pushed into the delivery tube and delivered to a bowl placed in the front of the press. The finished coins are forwarded to the examining department, where they are subjected to various tests before they are issued.

Testing.—In the case of gold coins and 50 cent and 25 cent pieces, each one is weighed separately on an automatic weighing machine. The 10 cent and 5 cent pieces are weighed in groups, in a hand scale, against a standard dollar weight; while the 1 cent pieces are weighed, in a hand scale, against an avoirdupois pound, which should contain exactly eighty of them.

The automatic weighing machines are very delicate instruments, the weighing being so accurate that the beam, when fully loaded, will turn with .01 of a grain. Each machine will weigh 20 coins per minute. The coins are fed into a hopper by the attendant. One coin is then pushed automatically on to a flat pan attached to one end of the beam; where it remains for 3 seconds; after which it is pushed off by the succeeding coin. During the time it is resting on the pan its weight determines which one of three shutes it shall drop into when it is pushed off. These shutes lead to three boxes; one for those coins that are too light, a second for those that are too heavy; while a third receives those that are of the correct weight. The latter are taken to the overlooking machine, where they are spread on a travelling band and carefully examined. Any that are found to be discolored or otherwise imperfect are picked out. The band travels over rollers, and, on reaching one end of the ma-

chine, the blanks are turned over automatically, so that the other side of the coins may be examined.

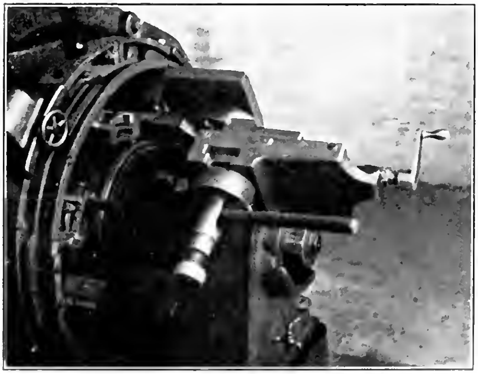
All the gold coins, and the 50 cent and 25 cent pieces that have successively passed through the foregoing tests, are then rung, singly, on an iron block, to find if they have the correct ring, and are not "dumb."

Those coins which have been found to be light, or heavy, or "dumb," or discolored, or in any way imperfect, are destroyed in the defacing machine, and remelted. The defacing machine is of similar design to the marking machine, but whereas the groove in the disc of the latter is a plain one, that in the defacing machine is divided into a series of notches, so that the edges of the defective coins are notched all the way round.

The good coins are delivered to the office, where they are counted into bags by the telling machine. This machine automatically counts, and delivers into a bag, any number of coins, as required. When the desired number have been delivered, the machine stops, until the trigger is again pulled for the next bag. Any number of coins may be counted on this machine, from 100 to 2,000; and any size of coin, from 50 cents to 5 cents.

In addition to the machinery mentioned above, there are several auxiliary machines, for various purposes, throughout the coining department. Weigh bridges, for weighing truck loads of raw metal; bullion balances, of various capacity, for weighing the metal during the processes of coining; automatic and hand drying cutters, etc.

For the storing of bullion the Mint is equipped with three strong rooms; one in the Mint office, one in the melting house, and one in the rolling and cutting department. These strong rooms are fire and burglar proof, and are fitted with doors, each of which has four combination locks controlled by triple time clocks, and arranged so that no door may be opened without the presence of at least two officials. A refinery will shortly be erected in connection with the Mint, in which gold will be treated by the electrolytic process.



LATHE ATTACHED TO ARMATURE.

Necessity, The Mother of Invention.

Mr. Elvin F. Brough, electrician, Tweed, Ont., sends the following interesting account of a difficulty he was placed in and the manner in which he extricated himself:

"Having had occasion to turn down the commutator on our small 25 kw. direct connected generator, I thought of a rather novel method of accomplishing it. As I could not put the armature in the lathe without removing the crank disc and flywheel, I succeeded, with the assistance of Mr. Cotton, our machinist, in bringing in part of the lathe to the machine, by securing the compound rest off the lathe to a small cast plate about 12 inches long, 6 inches wide and 1 inch thick, and clamping the plate to the two top studs of the outside main bearing of the generator.

After removing the brush holder ring and starting the engine, a smooth, even cut was easily taken off the commutator with a stiff boring bar held in the tool post.

I enclose a photo of the attachment in place, except that the brush holder ring is in place when the photo was taken.

This attachment could easily be used by others placed in the same position I was, by borrowing the compound rest from a neighboring machine shop, if they are not fortunate enough to have one in the plant.

Manitoba Civil Engineers Discuss Concrete.

The Manitoba branch of the Canadian Society of Civil Engineers met recently in the Manitoba University senate room, and Mr. C. W. Noble gave an interesting address on the subject of reinforced concrete and various styles of bars used for reinforcement. Mr. Noble traced the history of the use of steel with concrete, and showed the rapid growth of this form of construction.

The theory and testing of reinforced concrete beams was dealt with. The test, he said, should be made in such a manner that the loads will not form an arch and so give erroneous results. About 25 per cent. of the tested beams fail by reason of the sill. The other ways in which a beam may fail are by compression of the concrete, by tension, by elongation of the steel, and by shear. The main different types of bar used in reinforcement are plain bars of mild steel used almost entirely in Europe and England; corrugated bars of mild steel and twisted bars. A new method of construction is now used, whereby the steel frame is built complete in the shop, instead of being put together in the field.

Mr. Noble also spoke about the use of wire work and gave a table of relative cost in Winnipeg of high carbon, twisted, and plain bars of the new style corrugated bars, and of the Kohn and plain mild steel bars.

Mr. Noble said he has frequently to have tests made of cement and concrete, and expressed pleasure that the engineering department of the university proposed putting in a cement testing laboratory and also putting in a large machine for testing bars and materials.

Honor for Inspector H. F. Strickland.

Mr. H. F. Strickland, chief eelctrical inspector of the Canadian Fire Underwriters at Toronto, has received notice from Mr. C. M. Goddard, secretary of the Underwriters' National Electrical Association, Boston, that he has been appointed to act with the Committee on Street Railway Property from the Underwriters' National Electrical Association of the United States. This committee is composed of: Ralph Sweetland, Boston, Mass. (chairman); Wm. McDevitt, Philadelphia, Pa.; B. E. Loomis, New York; O. B. Johnson, Boston; and Mr. H. F. Strickland.

QUESTIONS AND ANSWERS

GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS:

1. All enquiries will be answered in the order received, unless special circumstances warrant other action.
2. Questions to be answered in any specified issue should be in our hands by the close of the month preceding publication.
3. Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment should be placed in the hands of a consulting engineer, caot be considered in this department.

Question No. 1.—Does an incandescent lamp consume more current as it gets older, and does a 110 volt lamp take more or less current than a 115 volt lamp?

Answer.—(1) No, the current consumed by an incandescent lamp grows slightly less all the time that it is burning, though the difference is not very marked, the consumption at the end of the useful life being only about 5 per cent. less than when the lamp was new. (2) A 110 volt lamp takes less current than one of 115 volts, that is of course assuming that you are speaking of lamps of equal candle power and efficiency. This means lamps of the same total wattage, in view of which you will see that as the lamp voltage is raised the current must be less and less, because the total wattage is the product of the current and voltage, therefore if one factor be increased the other must be decreased in exactly the same proportion, or else the product would not remain the same. In considering this question you must differentiate very carefully between lamps of different voltages, that is, lamps carefully tested and selected to find the proper voltage on which to run them, and lamps of the same voltage run on varying potentials. In this latter case the higher the voltage the larger the currents; to illustrate, a 115 volt lamp on a 115 volt circuit takes less current than a 110 volt lamp on a 110 volt circuit, but a 110 volt lamp on 115 volts takes more current than the same lamp does on 110 volts.

Question No. 2.—In testing meters built for use with current transformers, do the government charge a fee that is fixed by the rating of the current transformer or by the meter; that is, supposing they were inspecting a five ampere meter which had a dial that was suitable for use with a forty to one 200 ampere series transformer, would they charge you for a 5 ampere or a 200 ampere meter?

Answer.—There is something to be said on each side of the question. We are inclined to think that if you had the only meter calibrated, that the inspector would let you off with a 5 ampere fee, notwithstanding that the name plate of the instrument read 200 amperes. If the test, on the other hand, included the transformer as well as the meter, we think that without doubt the fee charged would be that for a 200 ampere meter.

Question No. 3.—Have all wattmeters to be inspected by the Government, if so how often. Are mercury and other chemical meters legal in Canada?

Answer.—The Electricity Inspection Act, which is the one governing the inspection of meters, calls for all integrating wattmeters that are used for the purpose of making a charge to be inspected. In view of this it is not necessary to have the Government test and seal meters that are used only for such purposes as checking a flat rate customer, whose bill is already determined by a flat rate agreement, or for the internal information of a plant, such as those on a generating switchboard. The Act states that meters must be reinspected within twelve months after the expiration of the five years, following the first or any subsequent inspection, which makes the maximum periods really six years apart. Chemical meters are not legal in Canada, as they are not direct reading, except that any that are in use may be retained, though no new ones may go in. We would point out, though, that the ordinary mercury meter is not a chemical instrument, but on the contrary is a motor meter, and as such is perfectly legal.

Question No. 4.—There are one or two devices on the market for preventing high tension current entering a building over the secondary wires. Do you think that they are a good thing to put on?

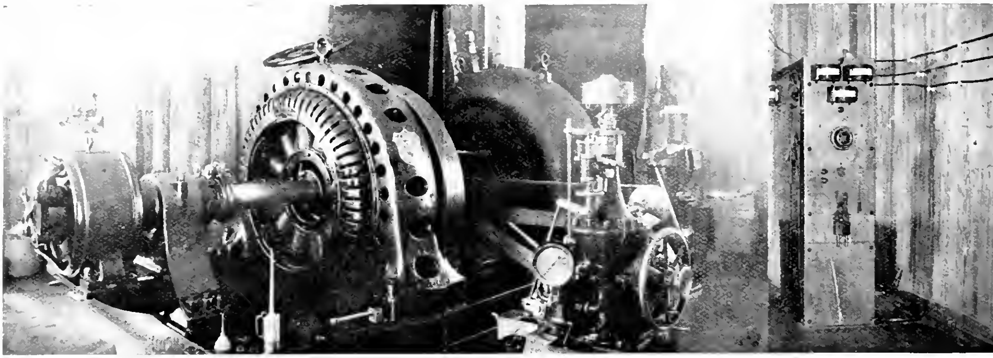
Answer.—We do not believe in cumbering a system with anything more than is really necessary, least of all an automatic device which, because it operates only once in a great while, may be out of order just at the time when it is most urgently needed. The best practice is without doubt to ground your secondaries. If this be thoroughly done you need have but little fear of any primary voltage which may get on to your secondary circuit.

Question No. 5.—Is there any easy way of getting a reduced voltage from ordinary transformers for starting induction motors without going to the expense of putting in a compensator?

Answer.—About the simplest way to do this is to connect the secondaries of the transformers which supply the motor in Y, and take a tap out at a suitable point in order to get the reduced starting potential required. This can be done very frequently with certain standard apparatus provided that the load on the motor is not so great as to require more than about 50 per cent. voltage to start it. For instance, assume transformers with a 2,080 volt primary and a 115-230 volt secondary connected to a 2,200 volt primary circuit, the primaries in the delta and the secondaries in Y. You will then get about 420 volts from the outside ends of the secondaries, and half that potential from their middle points. This would probably handle a 440 volt motor very satisfactorily, providing that the starting duty was not too heavy, all the extra apparatus needed being a plain triple pole double-throw knife switch. If you connect the motor to the three centre terminals, the outside leads from the transformers going to three of the end terminals, and the middle points to the other three, the switch when thrown on to the latter will give the motor half potential, and when thrown the other way will put it on to full voltage. You must understand of course that the scheme is not properly suitable for anything more than emergency use, if for no reason than that with it the motor takes more starting current from the line than if connected through a compensator.

Question No. 6.—Is the transformer regulation the rise in voltage when the load goes off, or the fall when a load is put on?

Answer.—The Standardization Rules of the Institute state that the regulation of a transformer is the ratio between the rise of secondary voltage from full load to no load, and the secondary voltage. It does not specifically say whether this latter quantity is to be taken as the value at full load or no load, but as full load is generally taken as the standard condition, we would judge that it is intended to be used in this case.



LISKEARD LIGHT HEATING AND POWER COMPANY'S PLANT.

New Liskeard's Power Developenent.

The Liskeard Light, Heat & Power Company's plant, part of which is shown in the illustration, is one which evidences the progressiveness of the Northern Ontario people. The company was formed last year to take over the plant owned by Mr. Kalil Farah at New Liskeard, together with the one hundred and sixty acres of land in connection with it. When taken over by the company the plant had the franchise for light, heat and power in the town of New Liskeard, where it had been supplying domestic and commercial lighting for four months, power being supplied by an auxiliary steam plant, consisting of a 200 h.p. Robb-Armstrong engine, belted to a 120 kw. 3-phase 60-cycle 2,200-volt Westinghouse generator running at 900 revolutions per minute. The greater part of the town was then already wired for domestic, commercial and street lighting. The hydro-electric power which now has been developed is known as Chester's Falls and is three miles west of the town of New Liskeard. The power development consists of a dam, a steel pipe line, and a power house containing one hydraulic unit direct connected to a generator. The dam is 24 feet high and not only increases the head, but also serves the purpose of a storage basin by means of which the capacity of the plant is greatly increased. A 36 inch diameter steel pipe line runs from the dam to the power house, a distance of 2,150 feet, giving a head of 105 feet.

The equipment of the power house is unique. The hydraulic equipment consists of one 360 h.p. single horizontal turbine in spiral scroll case with special oil governor and pressure regulator. The turbine is of special Swiss design and is supplied by the Allis-Chalmers-Bullock Company, of Montreal, who are manufacturers of the hydraulic machinery of Escher, Wyss & Company, of Zurich, Switzerland.

The turbine is direct connected to a 250 kw. 3-phase, 60-cycle, 2,500-volt generator, running at 600 revolutions per minute. An 8 kw. 120 volt exciter is direct connected to the generator shaft. The hydraulic and electrical equipment of the power house is supplied by the Allis-Chalmers-Bullock Company.

The current is transmitted to New Liskeard at 2,500 volts on a 3-phase transmission line. The steam plant will be used in case of emergency, and if necessary the two plants may be run together, as the necessary synchronizing apparatus has been installed for such purpose.

The company have lately bought the electric light plant in Haileybury and connected it to this water power. They also supply the corporation of New Liskeard with about one hundred horse-power for pumping the water for the waterworks, and expect soon to do the same in Haileybury. On the first of May they will put on an all-day service and expect several small motors will be installed. They have now about 3,000 incandescent lights and 16 arcs in New Liskeard and about the same in Haileybury.

The possibilities of New Liskeard in the matter of manufacturing are extensive, as there is a large tract of country to be supplied. Mr. H. Farah is superintendent of the company; Fred Hodge, Haileybury, chief electrician, and E. F. Snelgrove, New Liskeard, accountant.

Manitoba Telephone Arrangements.

The Manitoba Telephone Commission is preparing requisitions for material and planning the work to be carried out during the coming reason for the extension and development of the long distance service and subscribers' exchanges throughout the province. Particular attention is being given to applications for service required by the farmers. One of the first long distance lines to be extended is from Selkirk to Whytewold and Winnipeg Beach, and on to Gimli. This line will be a boon to Winnipeg people who spend the summer at Winnipeg Beach or Whytewold, and will give Gimli direct communication with Winnipeg.

In cases where municipalities are not making arrangements to build lines of their own, the farmers may join together and build lines of their own, and will be permitted to connect with the Government line at the nearest point. The Government will also build a circuit, if one is not already built, free of charge, to connect with the farmer's line from any exchange to the limits of the exchange. Service will be furnished at that exchange at an annual cost of from three to eight dollars, according to the size of the exchange.

In cases where the farmers' line is some distance from the exchange, the Government will build a line from the nearest exchange and maintain it for two dollars per quarter-mile per year. Individual farmers located within a short distance of the Government lines can make arrangements, if they wish, with the telephone commission to get service on the Government lines at the regular rate of $24 per year.

Slow Burning Weather-Proof Again.

Mr. J. Bennett, chief electrical inspector of the Canadian Fire Underwriters' Association for Montreal, writes to us as follows:

In your issue of April 4, I find an article headed "Slow-Burning Weather-proof Indoors," which consists of a letter from my confrere, Mr. H. F. Strickland, chief electrical inspector for Ontario, in which the question of a bulletin, which had emanated from this office, a copy of which I am enclosing you, is the subject of discussion. The difference of opinion is entirely due to the wrong application of the wording in the name of this wire. Rule 42 of the National Electrical Code is very clear and explicit, and states just exactly the character of wire that will be permitted for indoors installation in this territory. This wire is not so liable to make a path for flames nor to soften under heat, as the wire having an outer braid slicked down with a weather-proof compound.

The wire to which we object is now being manufactured by only one manufacturer in the United States, and some of the manufacturers in this district have written this department, agreeing with us that the wire should not be permitted under any circumstances, and congratulated us on the issuing of instructions explaining the matter. This office will be pleased to enlighten any interested parties regarding the interpretation of this, or any other question coming within its jurisdiction. I thank you for the opportunity given to explain what seems to be a misunderstanding.

The bulletin referred to by Mr. Bennett is as follows, and is dated January 27 last:

"As some misunderstanding appears to exist in the electrical trade with reference to a wire known as slow burning weather-proof wire, we judge it proper to advise you that the electrical department of this association will not issue certificates on electrical equipments in which this wire is used for interior installation. You will understand that the wire, called the above name, is not a slow burning wire in any sense, and is intended only for exterior construction. In places where the national Electric Code permits the use of slow burning wire, our electrical department will be prepared to accept slow burning wire or weather-proof slow burning.."

Mr. Strickland, when shown the above letter, said that there was no difference of opinion between Mr. Bennett and himself on the subject. The rules of the Montreal and Toronto districts did not conflict in any way. What they were both trying to get after was the ordinary weather-proof. Mr. Bennett's ideas and his own were the same on the matter, and the apparent disagreement resulted only from a mistaken interpretation of phraseology.

A Bull River Power Plant.

Electricity is growing in favor for mine work. In British Columbia the Bull River Power & Light Company on Bull river, near Fort Steele, is erecting an equipment which, it is expected, will supply power to mining and general industries throughout Southeast Kootenay. The enterprise involves the production of over 10,000 horse-power of electrical energy from the river, and already a grade more than 3,000 yards in length has been completed to accommodate a flume 16 feet by 8 feet on the inside. A gravitation dam seven feet high, with an inclination of 23 degrees from the perpendicular, is about to be installed at the intake and will rest on rock foundation from bank to bank.

The principle of this form of dam is that it represents the minimum of resistance to the downstream pressure of water, while each foot of rise over the toe of the structure increases the weight bearing on the foundations, so that the higher the water the safer the dam. This work will go in about one and a half miles above the falls, and the point where the Kootenay Central Railway will cross the river. The power house will be erected a short distance below the railway crossing and will be equipped with a complete outfit of percussion water wheels, operating under a vertical head of over 275 feet.

Already more than $80,000 has been spent on the undertaking, which includes the acquirement of a large amount of placer ground near and around the power house site. The placers on Bull river, both above and below the canyon, have been worked in a small way for years by the Fort Steele men, and considerable amounts of gold taken out. The indications and returns from the ground owned by the company have been most satisfactory.

The primary idea is to supply Cranbrook, Fernie, Hosmer, Elko, Marysville and Moyie with electric light and power. A further market may be secured for the power proposed to be used in the electrification of the mountain sections of the Crow's Nest section of the C. P. R.

George E. Henderson, manager for the company, returned recently from Merrilan, Wis., and is putting on a force of 60 men to complete the dam, flume and pipe lines.

Mr. Sothman Returns from Michigan Trip.

Mr. P. W. Sothman, chief engineer of the Ontario Hydro-Electric Power Commission, has returned from a trip to Grand Rapids, Croton and Muskegon, Mich., where he has been investigating the high power transmission lines. He inspected at Grand Rapids a power station and transmission line which carries 76,000 volts. Nothing definite has yet been decided about the equipment of the Ontario Hydro-Electric Power Commission's proposed transmision line, other than that some form of suspended insulator will be used. Mr. Sothman will also visit the Central Colorado Power Company's plant at Colorado Springs about the middle of the present month. This company is installing a 90,000 volt transmission line, which will be started in about a fortnight. Later Mr. Sothman intends to visit the Stanislaus Electric Company's plant and that of the Great Western Company in California, as well as some large plants in Mexico. During the summer also he will visit Europe to study the transmission lines in use there.

Opening for Canadian Drills.

Premier Louis Botha of the Transvaal, has sent a letter to Sir Wilfrid Laurier, pointing out that the Transvaal Government, in co-operation with the Transvaal Chamber of Mines, has arranged for a practical trial of small rock drills, suitable for narrow stoping work, under the working conditions obtaining on the Witwatersrand. All types of rock drill are eligible to compete. Drills using compressed air will be supplied with a pressure varying from 60 to 75 pounds per square inch at the working face. Two prizes of £1,000 respectively are offered. The competition will commence early in 1909 and will last about six months.

Contract Tender System was Bad.

A further appendix to the report of the Royal Commission which enquired into the collapse of the Quebec bridge has been laid before Parliament. It amplifies the previous condemnation of the Quebec Bridge Company's methods, pointing out in the first place that the method adopted by the company of procuring tenders by issuing a general specification and calling upon contractors to prepare plans in accordance therewith, was not in the best interests of the work. Owing to the financial weakness of the company, contractors had little assurance that they would get any return for their expenditure of time and money upon the preparation of plans. The latter task should have been entrusted to engineers independent of any contracting or manufacturing company.

"An error of judgment made by the Quebec Bridge Company," say the Commissioners, "was the selection of an engineer who did not possess the necessary special knowledge and experience to prepare the specifications." This specification, however, was accepted by the Government engineers, and formed an essential part of the agreement whereby the Government was to bonus the company to the extent of $1,000,000.

After contrasting the specifications of the bridge with those for the Forth and the Blackwells, Ottawa bridges, the Commissioners conclude that the specifications of the Quebec bridge "called for material of slightly lower ultimate strength than that used in any of the other bridges, while the bridge itself had the longest span of all.

"The specification throughout shows that the whole subject was not considered with sufficient care, not only from a technical standpoint, but from the practical or business standpoint as well. Inconsistencies are of frequent occurrence; ambiguity and lack of precise definition pervade the whole."

Not a Member of the Commission.

In an item in the last issue of The Canadian Electrical News, relating to the proposed extension of the municipal power plant at Nelson, B.C., Mr. Cecil B. Smith was wrongly referred to as a member of the Hydro-Electric Power Commission. Mr. Smith has not been connected with this Commission for over a year, and since May last has been senior member of the firm of Smith, Kerry & Chace, of Toronto.

Engineers Discuss the Oscillograph.

The regular meeting of the Toronto section of the American Institute of Electrical Engineers was held on the evening of Friday, April 24th, in the lecture room of the Engineering Building of the University of Toronto, twenty-four members of the section and eleven visitors being present. Seventeen were present at the luncheon at the St. Charles Cafe prior to the meeting. The chair was taken by Vice-Chairman W. A. Bucke, and the subject of the evening was introduced by Mr. H. W. Price, lecturer in electrical engineering at the University. Mr. Price discussed the oscillograph, showing by means of slides the essential characteristics of manufacture and of operation. Slides were also shown of oscillograph records of current and voltage taken on the occasion of sundry operations with direct and alternating current motors. Quite a number of oscillograph records taken from the lines of the Ontario Power Company at Niagara Falls were then shown and were explained by Mr. Johnson, assistant engineer to that company. Amongst these records were shown the current neutral ground lead of a transformer bank; the phenomena resulting from the use of open fuses as lightning aresters; the operation of an expulsion fuse; charging current of one hundred and sixty-five miles of line. One interesting record showed the use of the oscillograph for comparing the speed of two machines.

Mr. Price then placed an instrument in service, and those present were enabled to see its operation in many interesting circumstances.

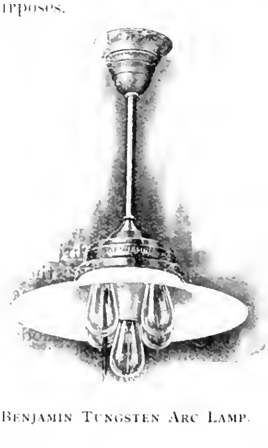
A short discussion on the uses of the instrument then followed, in which Messrs. R. G. Black, P. W. Sothman, H. W. Price, Johnson and W. A. Bucke took part. The efforts of Mr. Price to make this demonstration an interesting one were greatly appreciated by those present.

Alberta's Telephone Arrangements.

Hon. W. H. Cushing, of Calgary, Minister of Public Works for Alberta, recently met several Toronto financiers in connection with the proposed issue of bonds to provide for the payment of the purchase price of the Bell telephone system, recently acquired by the province. The province will issue a series of bonds redeemable in 30 years, and out of the earnings of the system will provide a sinking fund to meet them when they fall due. The Bell Company had a service of about 600 miles, with 20 exchanges in the province, and the Government system was of about the same extent. The rates will probably be maintained at $35 per year for business phones and $15 for farmers. The company will maintain its through line for long distance messages, but will not transact any business in the province.

A New Tungsten Lamp.

The new Benjamin Tungsten Arc Lamp, introduced by the Benjamin Electric Manufacturing Company, of Chicago, promises to become a general favorite. The fixture measures 25 inches over all and consists of a stem of 3-8 inch pipe and 3-4 inch casing, crowfoot, wires, deep canopy, cluster body, and 18 inch opal reflector. The brass base is provided with a conical shape, frosted, aluminum reflector, which materially increases the reflecting surface of the device. It is furnished in 4 to 6 lights, either with or without a centre lamp opening, and with or without a pendant switch. The fixture is symmetrical in outline and pleasing in appearance. It offers an effective, convenient and economical fixture for public lighting purposes.



Benjamin Tungsten Arc Lamp.

The Ontario Power Situation.

The seemingly chaotic condition of the negotiations between the Government and the various power companies wishing to sell power in Ontario, is to a certain extent being reduced to order, and before long will probably be settled properly. It does not seem likely at present that the Government will find much time to devote to the question until after the elections on June 8. Their deliberate hesitancy in the matter, however, leads to a generally accepted opinion that something will be done to prevent the ruinous competition which might arise if important long distance transmission lines had to be duplicated. The conciliatory attitude of Mr. Wm. Mackenzie since he obtained an interest in the Electrical Development Company is another point in favor of the belief that a reasonably ratisfactory solution for all parties will be reached. Current reports are to the effect that a solution may be worked out on the basis of the Ontario Power Company's serving all districts west of a line drawn from Hamilton to Owen Sound, and the Electrical Development Company serving the territory east of that line. At present the Government is maintaining silence upon the question.

An Indication of Good Times.

That the industrial crisis is now a thing of the past is continually being evidenced. In the United States anxiety was much more keen than in Canada, but all seems to be rosy now. The "Electrical World" has made some inquiries regarding the matter and says: Inquiries among the telephone, telegraph and cable companies show that the period of financial stress through which the country has just passed and from which it is rapidly recovering, has not affected these lines of business nearly so much as similar crises in the past. All of them have suffered with the rest of the commercial world, but all of them report considerable improvement in the immediate past and prospects for an early return to normal conditions. Speaking for the Commercial Cable Company, Vice-President C. G. Ward sums up the situation in the telephone and telegraph field. "There is, perhaps, no better barometer of business conditions," he says, "than the cable business, which responds to every marked change of conditions in the financial world. While our company has suffered along with the rest we have not felt the effects of the panic nearly as much as we did after certain panics in previous years. Moreover, conditions have improved so much in the last two months and our business has held up so well in the last six weeks, that it seems almost safe to prophesy that we will recover more quickly from this last panic than ever before. The reason for this is not a mystery, for any one can see that we have no fundamental causes for continued depression, such as overproduction or short crops. On the contrary, the farmers are wealthy and the American people are too impatient to let things stagnate for any length of time unless they are compelled, which is not the case at present. However, the Presidential year is always more or less of a deadweight. Business slackening has taken place so many times in the past during the pre-nomination period that business men have come to regard this slowing down as a natural and normal occurrence which must be reckoned with in forecasting the business year. The 1906 year was a phenomenally prosperous period, one that cannot be taken as a criterion. Any recovery from a period of financial stress must, in the nature of things, be more or less slow. But we are satisfied with a gradual increase and satisfied to take from two to three years to attain the height of prosperity from which we may fall in a month or a night. Business history is a record of such rises and declines, and in this particular instance it seems to me that the recovery from the fall will be more rapid than ever heretofore."

Western Union officers anticipate an increase in the telegraph business in the spring. The company is doing a normal business, everything considered, and conditions are improving, but in the last few months the Western Union's business was smaller than in the same period during previous years. "The business of the company is picking up," says Secretary Brewer, "and we expect a further increase in April as conditions now indicate."

Business Holding Up Well.

Referring to business conditions generally, Mr. W. H. Corbett, president of the Willamette Iron & Steel Works of Portland, Ore., said recently to the ELECTRICAL NEWS: "We are very glad to be able to say that, notwithstanding the general depression which is in force all over this country, we have thus far managed to keep fairly busy during the dull months of the winter. At present, we have in hand three complete stern wheel steamboats, one for the United States Government, one for the Pend O'Reille River Navigation Company, and one for Alaska.

"We have also managed to sell considerably more logging machinery than we had anticipated, some of our recent shipments being one 10 x 13 Humboldt yarder to Chapman Timber Company, Scappoose, Ore.; one 10 x 14 Humboldt yarder to West Side Lumber Company, Tuolumne, Cal.; one 11 x 13 Humboldt yarder to Holmes-Eureka Lumber Company, Eureka, Cal.; one 10 x 13 Mogul yarder to Silverton Lumber Company, Silverton, Ore.; one 10 x 13 Mogul yarder to Penensula Lumber Company, Portland, Ore.; one 9 1-2 x 11 combination to Southerland, Brewer Lumber Company, Yacolt, Wash.; one 10 x 13 Humboldt yarder to Stimson Mill Company, Ballard, Wash.

"In addition to these standard engines we have four special hoisting enginees for the United States Government, a complete smelter for a Southern Oregon mining company, and a number of other special machines on a contract basis. This, along with the normal amount of breakdown and jobbing work which comes to us, keeps us fairly busy, with indications of a resumption of normal conditions within the next month or two."

English Engineer Sees Bright Future for Canada.

In a lecture delivered at Birmingham, Mr. W. Rowley, mining engineer, of Leeds, gave his impressions of a visit to Canada paid with the British Institute of Civil Engineers. He was, he said, much impressed with the greatness of Canada and the possibilities of its future. With reference to the iron and steel trades, he was much struck by the great use that was made of labor-saving appliances. Electrical power was more extensively used, more developed, and much cheaper than in England, and was in almost universal employment for the purposes of commercial, industrial, and private life. Canada and the United States had realized the necessity of educating engineers by a thoroughly scientific training at the universities. With few exceptions, the present mining and civil engineers of eminence and the younger men coming on had all graduated in engineering.

American General Electric's Record Year.

The annual report of the General Electric Company of the United States for the year ended January 31, 1908, which will be issued in May, will, it is reported, show gross orders billed to customers of approximately $70,000,000 and net earnings for dividends on the $65,167,100 capital stock of about $9,800,000 or 15 per cent. The share earnings for the company in the previous fiscal year ending January 31, 1907, were $8,427,842, equal to 13.2 per cent. on the $63,572,800 stock outstanding at the end of that year. The figures for last year establish a new high record, which was made possible by the large amount of business carried over from the 1906 year and the large volume of orders booked during the first six months of the year just ended. In the fiscal year of 1904 the company shipped to its customers a total of $41,699,617 of electrical supplies and apparatus and the total of $70,000,000 for the last year is an increase of about $30,000,000 or 70 per cent. Net earnings have increased from $7,865,376 in 1904 to about $9,800,000 last year, a gain of $2,000,000 or 25 per cent., which means that the ratio of net profits to gross earnings, which in 1904 was 18.8 per cent., declined in 1908 to 14 per cent., a shrinkage in four years of nearly 5 per cent. Since 1903 the selling policy of the General Electric Company has undergone a radical change. In 1903 the company did a gross business of $36,685,598 and net profits were $10,232,839, equal to 28 per cent. of gross earnings for dividends. Results for 1907-8 show that this ratio has been cut exactly in two and in the interval gross sales have nearly doubled. The reduction in price of electrical apparatus made is stated to be in accordance with the policy of the General Electric Company that the surest way of maintaining its position in the electrical field is to accept a moderate rather than an exorbitant ratio of profit. Between 1904 and 1907 the outstanding stock has increased from $43,866,700 to $65,167,400 and the dividend percentage on the outstanding stock for the last five years, beginning with 1904, was 17.9, 13.9, 13.4, 13.2, 15. The amount of business booked during the last four months of the 1907 year was about 50 per cent. smaller than during the first five or six months.

Mr. C. B. Smith on Power.

Some 60 members of the Port Arthur Club enjoyed an interesting address from Mr. Cecil B. Smith recently on some phases of power development in Ontario.

Mr. Smith gave a concise history of the development of electric energy for lighting, industrial and transportation purposes. An induced electric current was developed in a small way 30 years ago by mechanical means and friction machines. The second discovery showed the possibility of transmitting power to a distance, since brought up to 200 miles.

What the limit of power would be, Mr. Smith thought it difficult to foretell, for what is the limit one day is exceeded on the morrow. The maximum of the present was thought to be 60,000 volts energy, but in Rio de Janeiro, Brazil, they are now making a development at 100,000 voltage.

Electric energy has effected, among other things a wonderful revolution in flour milling by reducing the cost of operation and making it possible to grind wheat at points that would have otherwise been placed out of consideration.

It has also made wonderful changes in the operations of mining, lumbering, transportation, etc. Producer gas, it has been claimed, could be made at $10 per horse-power, but in that but half the story was told, only the cost of coal being computed. In transportation electricity is gradually eating into the steam railway's field. The New York Central, New York, New Haven & Hartford lines, and other railways are operating electric trains on quite a large scale.

Canada has been a wonderful field for the development of electrical energy, among the big powers now in operation being Niagara Falls, Montreal, De Cue at Hamilton, Copper Cliff and Kakabeka.

Regarding the Port Arthur district Mr. Smith spoke in the most optimistic terms. "At Silver Falls," he said, "you have one of the most wonderful hydraulic powers in Canada. It stands almost without a rival for cheapness, capacity and uniformity. Dog Lake power, with its 350-foot head and 53 miles of pondage, is a larger power than Kakabeka. Its ultimate development he believed to be double that power. With the installation of power in Port Arthur he thought that among other industries this should be a good point for the manufacture of the tool steel required for the West. This would bulk up to considerable proportions."

Mechanical Engineers Will Discuss Clutches.

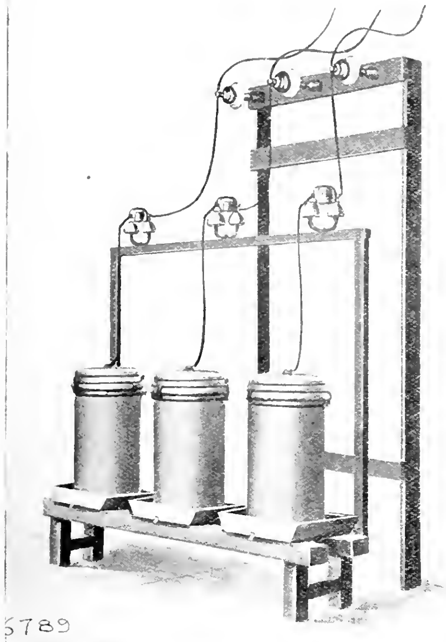
The next meeting of the American Society of Mechanical Engineers will be held Tuesday evening May 12, in the Engineering Societies' Building, New York. The paper will be by Mr. Henry Souther, of the Henry Souther Engineering Corporation, Hartford, Connecticut, on the subject of "Clutches," with special reference to the types used on automobiles. Their development will be shown by lantern slides. The meeting will be important not only to those directly interested in automobile construction, but to all who have to do with the use of clutches for machine tool work, power transmission, hoisting machinery, textile and other classes of machinery. The meeting will afford an opportunity for the full discussion of their design and use. The discussion will be continued at the semi-annual meeting of the society at Detroit, Michigan, from June 23-26.

Montreal Railway's Report.

The statement of earnings and expenses of the Montreal Street Railway for March and the six months of the present fiscal year shows a decrease in surplus earnings for the single month of $8,888, representing 20.71 per cent. less than the surplus for March, 1907. There was an increase in both net and gross receipts, and an increase in fixed charges of nearly 21 per cent. For the six months there was a satisfactory increase in the surplus of $42,476, the actual surplus being $328,989, against $286,513 for the corresponding period of 1907. Fixed charges for the half year only increased 13.98 per cent., or $33,403. There was a substantial increase in gross receipts for the six months, which were $1,747,136, against $1,599,048, while net were $601,271, compared with $525,391 the previous year.

Addition to Toronto Firm.

Mr. E. E. Keller, for over 20 years connected with the Westinghouse interests and for 14 years vice-president of the Westinghouse Machine Company, having completed his duties as receiver and general manager, has severed his connection with the management of the company. Mr. Keller will take a much-needed rest and will then devote most of his time to several personal interests.



WESTINGHOUSE TYPE "E." LIGHTNING ARRESTER.

Westinghouse Type "E" Electrolytic Lightning Arresters.

As the result of experiments covering a number of years, the Westinghouse Electric & Manufacturing Company have developed the electrolytic lightning arrester, shown in the accompanying illustrations. It consists of a number of aluminium plates pressed into tray form so that when set one within the other, separated by small insulating washers, they may be built into a column capable of withstanding high voltages and still retain the safety valve characteristics of a single plate. These columns are made in two sizes, one for voltages between 4,000 and 7,500, the other for voltages between 7,500 and 15,000. The columns are enclosed in substantial stoneware jars. The jars may be mounted one upon the other to form arresters for any desired voltage. A gap on the line side of the electrolytic elements, which will withstand the normal voltage of the system, breaks down with over-voltage and permits the surge to discharge through the electrolytic units.

The electrolyte is dissolved in pure water and poured into the top of the arrester unit. It thus fills the first tray and runs over into the second, and so on through the column, the surplus escaping through a hole in the bottom of the containing jar through the next jar, if there be more than one, to the pan at the bottom. The electrolyte fills only the trays and not the jar, so there is no opportunity for the current to pass except from tray to tray. Each unit when placed in the pan or on another unit automatically makes contact.

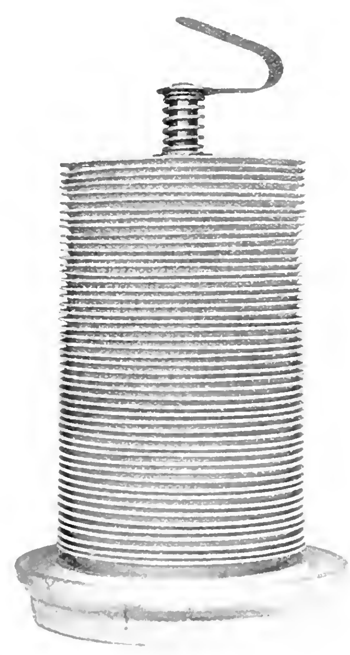
The electrolytic solution causes a very thin film to form on the aluminum plates. This film has an apparent resistance of very high value when moderate voltages are impressed upon it, but when the voltage reaches a certain value, it breaks down in myriads of minute punctures, making almost a short circuit. As soon, however, as the voltage is reduced again, the punctures seal up at once and the original high resistance reasserts itself. These arresters are arranged for installing either indoors or out, as suits the convenience of the user.

New Machinery at Manitoba Iron Works.

The Manitoba Iron Works, Limited, have completed the installation of electric motors throughout their shops, having discarded steam except for heating purposes. They have installed approximately 200 horse-power distributed amongst twelve motors, and the whole plant is now operated by electricity purchased from the Winnipeg Street Railway Company. A fine new compound duplex intercooler air compressor, Rand make, has been installed, and a new Allen riveting machine and several large air hoists for the boiler and structural shop, which, with many minor improvements, have placed this fine plant in a high state of efficiency for the season's work. The company have already booked a large number of orders for execution this season.

Niagara Power for Detroit.

The Ontario Power Company, with which the Hydro-Electric Power Commission has signed a contract to supply power to the municipalities, is said to be considering a proposition to build a high tension line from Niagara Falls to the Detroit river. It is said that the Ontario Power Company is negotiating to sell a big block of power to Detroit, and that on the outcome of this depends to a large extent the building of the western transmission line.



ARRESTER WITH CASE REMOVED.

Trade Enquiries.

The Dominion Government Trade and Commerce reports contain the following trade enquiries. Readers of "The Canadian Electrical News and Engineering Journal" may obtain the names of enquirers by writing to us. State number of enquiry:

300. Vulcanized Fibre—Manchester firm wishes to correspond with Canadian manufacturers of hard vulcanized fibre for electrical purposes.

310. Machinest Supplies—Manchester firm asks prices and catalogues of machinist supplies from Canadian manufacturers.

315. Copper Ingots—Manchester firm wishes to correspond with Canadian exporteds of copper ingots or bars.

327. Agency—Hull, Eng., firm dealing in engineer's specialties seeks agency of Canadian manufacturer of metallic packing.

328. Laundry Machinery—A firm of laundry machinery specilists in Keighley, Eng., wish to be put in touch with first-class houses in Canada to handle specialties, comprising high class modern hand or steam power machinery for laundries.

340. Blocks, Steering Wheels, Etc.—Scotch firm manufacturing blocks, steering wheels and stamped goods used by engineers and shipsmiths, wishes to get into touch with Canadian buyers.

353. Machinry—Large Birmingham firm can supply Canadian firms with presses, dies, lathes, shears, stamps, and all kinds of machinery.

405. Patents and Machinery Appliances—North of England firm in close touch with engineering trade will take agency for a patent or any article used in connection with machinery.

418. Agency—English firm of steel manufacturers turning out specialty with very large sale in Great Britain desires to be represented in Canada by enterprising firm with good connections and branches throughout the Dominion, preferabl yone doing business with users of tool steels, such as railroads, locomotive and bridge builders, mining corporations, etc.

431. Lattice Steel—Lancashire firm manufacturing lattice steel for lighting and power transmission, and general ironwork for tramways and railway purposes, etc., desires to hear from Canadian importers of the same.

437. Cutlery, Etc.—A Sheffield firm wishes to appoint an agent in Canada on a commission basis for the sale of their cutlery, files, saws, tools, etc.

447. Scrap Steel.—A Scottish firm makes inquiry for the names of shippers of scrap steel and malleable iron in Canada.

464. Agents.—A London, England, firm anxious to market oil engines in Canada desires suitable agents to represent them.

480. Agency.—An English screw firm making all kinds of bolts, nuts and screws want the services of a Canadian firm to handle their goods among engineers and others. Preference given to a house having representatives covering the country.

504. Electrical Machinery.—A large London firm would like to open up a connection with first-class houses in Canada using every kind of electrical appliances, particularly machinery.

511. Machinery.—A London firm exporting all classes of hard goods, such as railway material, machinery, cast and wrought iron tubes, tin plates, Canada plates, etc., desires to be placed in touch with Canada importers of such goods.

515. Agent.—An English firm manufacturing fibrous steam packing is desirous of being represented in Canada.

576. Engineering Goods.—A well connected firm of engineers' agents will welcome catalogues and price lists from Canadian manufacturers of machinery, engineering goods or specialties, seeking an export trade with the North of England.

578. Gas and Oil Engines.—An English firm of gas and oil engine makers enquires for the name of a likely merchant or agent to sell their goods.

Sparks.

The rural telephone system at Stratton, Ont., owned by Ostor Brothers, is to be considerably enlarged.

J. L. Stiver, Toronto, has been appointed assistant inspector of gas and electricity in the Toronto inspection district.

Private corporations are said to be engaged in a lively competition for the street railway franchise at Edmonton, Alta.

A rural telephone company is being formed at Lang, Sask., to build about 48 miles of pole line. J. W. Franks is interested.

The Moose Jaw City Council have decided to take fresh tenders for the 500 kilowatt generating unit. Bids close May 17th.

At Fergus, Ont., a rural telephone company has been organized by J. C. Templin to connect with Eramosa, Nichol and Lara frade.

The farmers of Douglastown and Dalesboro' district, Carlyle, Sask., are organizing a rural telephone company. Estimated cost of proposed system $102 per mile.

The British Columbia Telephone Company will build a long distance line from Duncans, B.C., to Victoria, a distance of 42 miles. F. Halse, Vancouver, is superintendent.

The Alberta Government will construct a rural telephone line between Red Deer, Alta., Edwell and Pipe Hills. E. Edward, Edmonton, is superintendent of construction.

The International and Rainy River Telephone Company, Rainy River, Ont., contemplate the building of several extensions this summer and the installation of a local system at Emo.

It is stated that the Quatsimo Power and Pulp Company, of Quatsimo, B.C., have just completed plans for the construction of a large pulp mill, and that work will start immediately.

The city of Port Arthur, Ont., is contemplating the raising of Onion Lake dam on Current river by eight feet to increase the water storage for the power plant estimated to cost $10,000.

The contract for electrical fixtures for the de Salaberry school at Montreal, Que., has been awarded by the Catholic school board to the Standard Construction Company, same city, at $4,683.

The British Columbia Electric Railway Company, New Westminster, B.C., have awarded the contract for the proposed extension of their car shops to W. W. Forrester, same city, at $20,000.

The British Columbia Electric Railway Company, Limited, has just installed a 2,000 volt 65 horse-power motor in the new saw mill on the Ferris road, South Vancouver, which has been built by Chas. Warwick.

Mr. E. G. Blackwell, of Vancouver, has lately moved his address from Richards street to 519 Pender street. He has also added the wire rope firm of Geo. Crawford, Wakefield, Eng., to his list of agencies.

A report is current that an American telephone company have made an offer to the New Westminster City Council to install a telephone system to operate in competition with the British Columbia Telephone Company.

The Canadian Westinghouse Company's net earnings were $427,000, an increase of 23 per cent. over those of last year, and of this $215,000 was paid in dividends. The balance was placed in the reserve account.

Two new industries will probably be started in New Westminster, B.C., at an early date, F. Page planning the erection of a pulp mill and Ewen Martin the installation of a plant for manufacturing tile pipe and brick.

The power and light committee of Calgary, Alta., are considering the question of installing an additional engine, which will practically double the output of the civic power plant. H. Creaves is chairman of the committee.

The following contracts have been let in connection with the new public baths at Toronto: Plumbing, K. J. Allison, $8,990; heating, Geo. Syne, $4,450; wiring, W. J. McGuire, $500; machinery, Toronto Laundry Machine Compauy, $2,500.

The British Columbia Telephone Company contemplate the installation of a cable telephone system at Kamloops, B.C. They are also planning to construct telephone systems in Fruitlands and Tranquille. G. C. Hodge, Nelson, B.C., is district superintendent.

It is announced that a new discovery in connection with the turbine engines of the Dreadnought has resulted in a great increase of speed. In a twelve-hour trial just held, the battleship averaged 20 1-2 knots, which is only half a knot below her designed speed.

Mr. J. B. Fregeau, of Three Rivers, Que., was superintending the placing of some machinery at the north shore electric plant, near the St. Maurice bridge recently, when he suddenly fell to the ground. On examination it was found he was dead. Apoplexy was the cause.

H. G. Legrand, of Montreal, chief bridge designer of the G. T. P., recently returned to Edmonton after an inspection of the site for the proposed Pembina river bridge. Mr. Legrand is making a tour of inspection in connection with bridge work to be started this summer.

Jonathan Marshall, a married man, aged 57, was accidentally killed on April 25 at the power house of the Western Counties Electric Company, Brantford. Marshall, with a companion, was repairing a portion of the galvanized iron roof, which had been blown off by the storm in the afternoon, when he happened to place his foot on a live wire, at the same time grasping a hanging piece of roofing. The shock was not sufficient to kill him, but he lost his balance and fell 30 feet, head first, striking the left side of his head on the solid cement floor.

Sparks.

Mr. Hugh B. Gilmour, B.C., representative of the Waterous Engine Works, of Brantford, leaves in May for a six months' trip to Europe. He will be accompanied by Mrs. Gilmour. During his absence his son, R. N. Gilmour, will be in charge of the business.

Mr. William Mackenzie refuses to say anything as yet regarding the report that the Ontario Government, through the Hydro-Electric Commission, is negotiating with the Electrical Development Company for power east of Hamilton in order to save the duplication of pale lines.

The Department of Public Works have awarded to the James Morrison Company, at $2,000, the contract for wiring the electric light fixtures at the Parliament Buildings, Toronto. This is in addition to the contract for rewiring recently secured by the same company at $10,000.

The Manitoba Government telephone commissioners are preparing plans and specifications ror the long distance work to be undertaken this summer, also for the enlargement of the Winnipeg city system. Several new exchanges will be built and the work will be proceeded with immediately.

At a special meeting of the City Council of New Westminster, B.C., and officials of the British Columbia Electric Railway Company, it was stated by J. Buntzen, managing director, that the London, Eng., directors of the company would take up the matter of building a new dam at Coquitlam lake.

The Canadian Public Ownership League at a recent Toronto meeting passed a resolution commending the Manitoba and Alberta Governments for establishing publicly-owned telephone systems, and recommending Ontario to do the same thing. The League also condemned the granting of government assistance for the construction of new lines of railway, and urged public building and ownership of new colonization roads wherever needed.

Part of the power and light sub-station at Nelson, B.C., was destroyed by fire on April 25. It is supposed that the starting of one of the street cars from the barn caused a collapse of an overheated switch at the sub-station, the bottom blew out and the oil took fire, the blaze spreading rapidly. All the frame portion of the building was destroyed, but the brick addition was saved by the brigade after a hard fight. The building was occupied jointly by the city, the West Kootenay Power and Light Company, and the Nelson Tramway Company.

MOONLIGHT SCHEDULE FOR JUNE.

Date.	Light.	Date.	Extinguish.	No. of Hours
Jun. 1	7 50	Jun. 2	3 50	8 00
2	7 50	3	3 50	8 00
3	7 50	4	3 40	7 50
4	10 20	5	3 40	5 20
5	10 50	6	3 40	4 50
6	11 20	7	3 40	4 20
7	11 40	8	3 40	4 00
9	0 10	9	3 40	3 30
10	0 40	10	3 40	3 00
11	1 10	11	3 40	2 30
12	1 40	12	3 40	2 00
13	No Light	13	No Light	
14	" "	14	" "	
15	8 00	15	10 20	2 20
16	8 00	16	11 20	3 20
17	8 00	18	0 10	4 10
18	8 00	19	0 50	4 50
19	8 00	20	1 30	5 30
20	8 00	21	2 00	6 00
21	8 00	22	2 30	6 30
22	8 00	23	3 00	7 00
23	8 00	24	3 30	7 30
24	8 00	25	3 40	7 40
25	8 00	26	3 40	7 40
26	8 00	27	3 40	7 40
27	8 00	28	3 40	7 40
28	8 00	29	3 40	7 40
29	8 00	30	3 40	7 40
30	8 00	Jul. 1	3 40	7 40
		Total	....	154 10

Sparks.

It is stated that Skinner and Colison, of Estevan, Sask., will install an electric light plant at Killarney, Man.

The power and light sub-station at Nelson, B.C., was last month the scene of a conflagration that entailed a loss of $24,000.

The electrified line of the Ohio Electric Railway between Lima and Defiance, O., formerly the Columbus and Lake Michigan steam road, will be put in operation about June 1.

The Sunbeam Incandescent Lamp Company, of Canada, Limited, Traders Bank Building, Toronto, have purchased a site on Dufferin street for the erection of a factory.

The rural municipality of Springfield, Man., are considering the installation of a telephone system this summer. C. Christopher is secretary and treasurer.

The organization of a telephone company is in progress at Lumsden, Sask., and it is hoped to have a complete local system installed by the end of the summer.

The ratepayers of Indian Head, Sask., have approved by-laws to raise $10,000 for extension of waterworks, $10,000 for electric light, $53,000 for waterworks and other purposes and $12,000 for the erection of a firehall.

Cannel and Spencer, Edmonton, Alta., have been awarded the contract for the construction of the power house to be built in connection with the Edmonton general hospital at $40,000. R. P. Barnes is the architect.

Hon. J. M. Gibson, president of the Cataract Power Company, of Hamilton, has intimated that on account of the tightness of the money market the radial line will not be completed this year from Oakville to Toronto.

At a recent meeting of the water commissioners of Victoria, B.C., plans for the Smith's Hill portion of the new waterworks system were adopted and construction of the $100,000 reservoir will be put in hand at once. Tenders will be called for the requisite steel piping and machinery.

Engineer Le Baron's plans for extensive improvements to the Fraser river at New Westminster, B.C., have been approved at Ottawa, subject to slight modifications, and the fulfilment of the project is now assured.

May.

Sparks.

The British Columbia Electric Railway Company have purchased the Vulcan Boiler Works property, New Westminster, with the view, it is stated, of future extensions.

Mr. Harry Heinlow, who has been manager of the Steveston branch of the British Columbia Electric Railway Company since its inception, has resigned owing to ill-health.

Mr. Herbert W. Kent, formerly general superintendent of the British Columbia Telephone Company, Limited, Vancouver, has been appointed sales agent for British Columbia by the Northern Electric & Manufacturing Company, Limited, of Montreal.

The latest company to negotiate to bring natural gas into the Forest City is the North American Oil & Gas Company, who are seeking to get distribution rights. The company have a capital of $100,000, and claim to be able to supply citizens at a rate of 35 to 40 cents per 1,000 cubic feet.

J. B. McRae, C.E., and William Kennedy, C.E., of Ottawa, have been in consultation in reference to the plans for the new Chaudiere dam, the construction of which, this season, was decided upon at a recent meeting of the Ontario and Quebec owners. The new structure will be of steel and concrete construction and will cost in the neighborhood of $150,000.

A pair of the largest boilers ever manufactured in Western Canada were recently installed in the power house at Manitoba Agricultural College, Winnipeg, by the Vulcan Iron Works. With a length totaling sixteen feet eight inches and a diameter of eight feet, these huge boilers furnish 150 horse-power. They are built to carry 130 pounds pressure, and have been tested to 200 pounds. The shell is five-eighths of an inch thick, and around a fifty inch fire box are eighty three and one-half inch tubes, each thirteen feet long. The make is known as the Scotch boiler.

The following concerns have lately secured a charter: La Compagnie de la Turbine Simplex Gallinard, Limited, Montreal, Que., incorporated to exploit and manufacture the patent known as the simplex turbine, capital $250,000; incorporators, Paul Gallinard, J. Monier, E. Leclerc, A. St. Denis and others, all of Montreal. Chaudiere Basin Power Company, Limited, Montreal, Que., capital $150,000; incorporators, F. H. Manley, J. N. McKenzie, A. C. Wilkinson and G. P. Grant, all of Montreal. Byron Telephone Company, Limited, Byron, Ont., capital $15,000; incorporators, R. McEwan, A. J. Rollins, H. Wickerson, W. Meriam and A. Kains.

Sparks.

Hon. J. H. Howden, Minister of Telephones and Telegraphs, Winnipeg, will receive tenders up to May 10th for material and telephone instruments for Manitoba Government construction this season. Specifications may be seen at office of Chief Engineer, Department of Telephones, Winnipeg.

The following are among the new electric car lines for Toronto, which have been agreed upon by Mr. Wm. Mackenzie, Manager R. J. Fleming, and City Engineer Rust: University avenue, from Queen to College; Wellington street, from Church to York; Adelaide street, from Church to York; Richmond street, from Church to Victoria; Bay street. A line connecting with a downtown route will be constructed to serve the northwest section of the city. A route running off either Gerrard or Broadview avenue, and using the Don, is proposed.

THE CANADA ELECTRIC CO.

Are now located in their new premises

230 Dorchester Street West, Montreal,

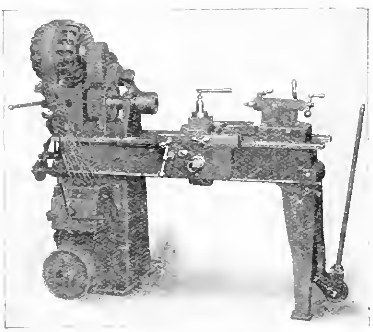
Where they carry everything in

ELECTRICAL SUPPLIES

Write us for anything you require in our line, we will be pleased to quote prices.

THE CANADA ELECTRIC CO.

LACASSE ROSSEAU, Elec. Eng. Manager. 230 Dorchester Street West, - Montreal.



Westinghouse Motor Driving Williams & Wilson Portable Lathe

Individual Motor Drive

Readiness

You often want to use a machine tool just for a few minutes, but want to use it when you want it. An individual motor-driven tool is always ready at a second's notice, and you do not have to keep a line shaft running all the time just to be able to use the tool for a few minutes.

Canadian Westinghouse Co., Limited

General Office and Works: **HAMILTON, ONT.**
For particulars address nearest Office:

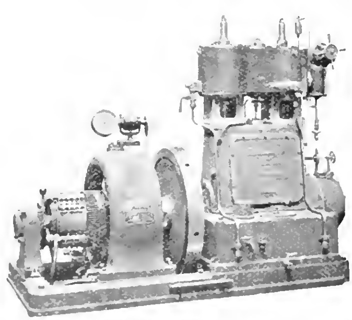
Traders Bank Bldg., TORONTO.
439 Pender St., VANCOUVER.
922-923 Union Bank Bldg., WINNIPEG.
Sovereign Bank of Canada Bldg., MONTREAL.
158 Granville Street, HALIFAX

Belliss & Morcom Limited, Engineers

Established over 50 years.
Telegrams: "Belliss, Birmingham."
Code: A.B.C., 5th Edition.

BIRMINGHAM, ENGLAND

LONDON OFFICE:
8 Victoria Street, S. W.



Representing our Two-Crank Compound Type Engine.

ENGINES

Direct, Rope or Belt Drive

FOR

ELECTRIC POWER, LIGHTING, TRACTION AND MILL DRIVING, also CONDENSING PLANTS.

ADVANTAGES: Self-Lubrication Simplicity; Strength; Experience Low Cost; Reliability; Minimum Maintenance; Compactness; Good Governing; Durability; Maintained Efficiency; Quiet Running.

3,800 Engines supplied or building, representing upwards of 650,000 H.P., in sizes ranging from 5 to 2,700 B.H.P. of Compound & Triple-Expansion Types.

Sole Agents for Canada: **LAURIE & LAMB,** 212 BOARD OF TRADE BUILDING, **MONTREAL, CAN.**

Telegraphic Address: "Larco" Montreal. Codes: A.B.C. 5th Edition & Western Union.

OKONITE

TRADE MARK
Reg. U. S. Patent Office

THE STANDARD FOR RUBBER INSULATION

OKONITE INSULATED WIRES AND CABLES

maintain their high electrical efficiency under the most exacting conditions. They are not affected by extremes of temperature, commercial acids or alkalies. They improve with age.

The plain insulation [without a protective covering] is soaked three days in water before being tested.

THE OKONITE COMPANY, LIMITED
253 Broadway, NEW YORK, U.S.A.

REPAIRS

ARMATURES REWOUND
COMMUTATORS REFILLED
TRANSFORMERS REWOUND

DON'T SHUT DOWN

As we can loan you something while we make your repairs

WE BUY, SELL OR EXCHANGE
ALL KINDS, SIZES AND TYPES OF
ELECTRICAL APPARATUS

FRED THOMSON & CO.

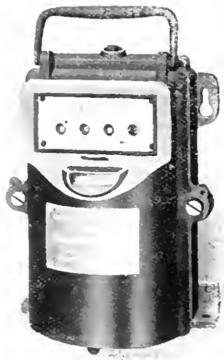
326-328-330 West Craig Street
MONTREAL

Phones Main 3149
Mount 518

In the Electrical
Business Since 1880

The Gas and Electric Power Co.

Alt. Current Watt Meter



Complete with Case

SOLE AGENTS FOR

"Ferranti" Lmited

Manufactures of

Successful
Safe and
Sure

Alt. and Direct Current } **Watt Meters**

Electrical Instruments

High and Low Tension, Oil } **Switches**

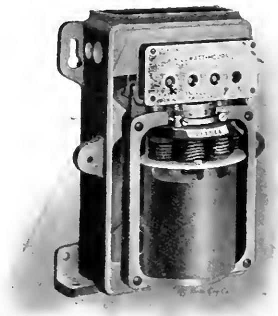
Circuit Breakers

Time Limit Relays, etc., etc.

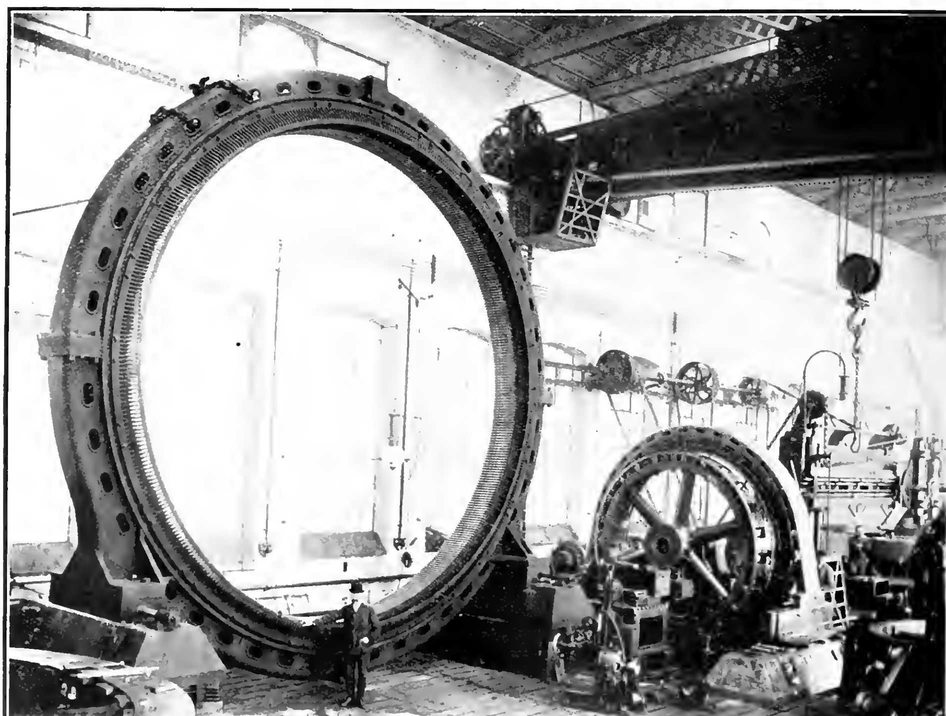
Intergrating WATT METERS built with our latest cyclometer dial.

Switch Boards built in Toronto

Alt. Current Watt Meter



Shewing Interior without Case

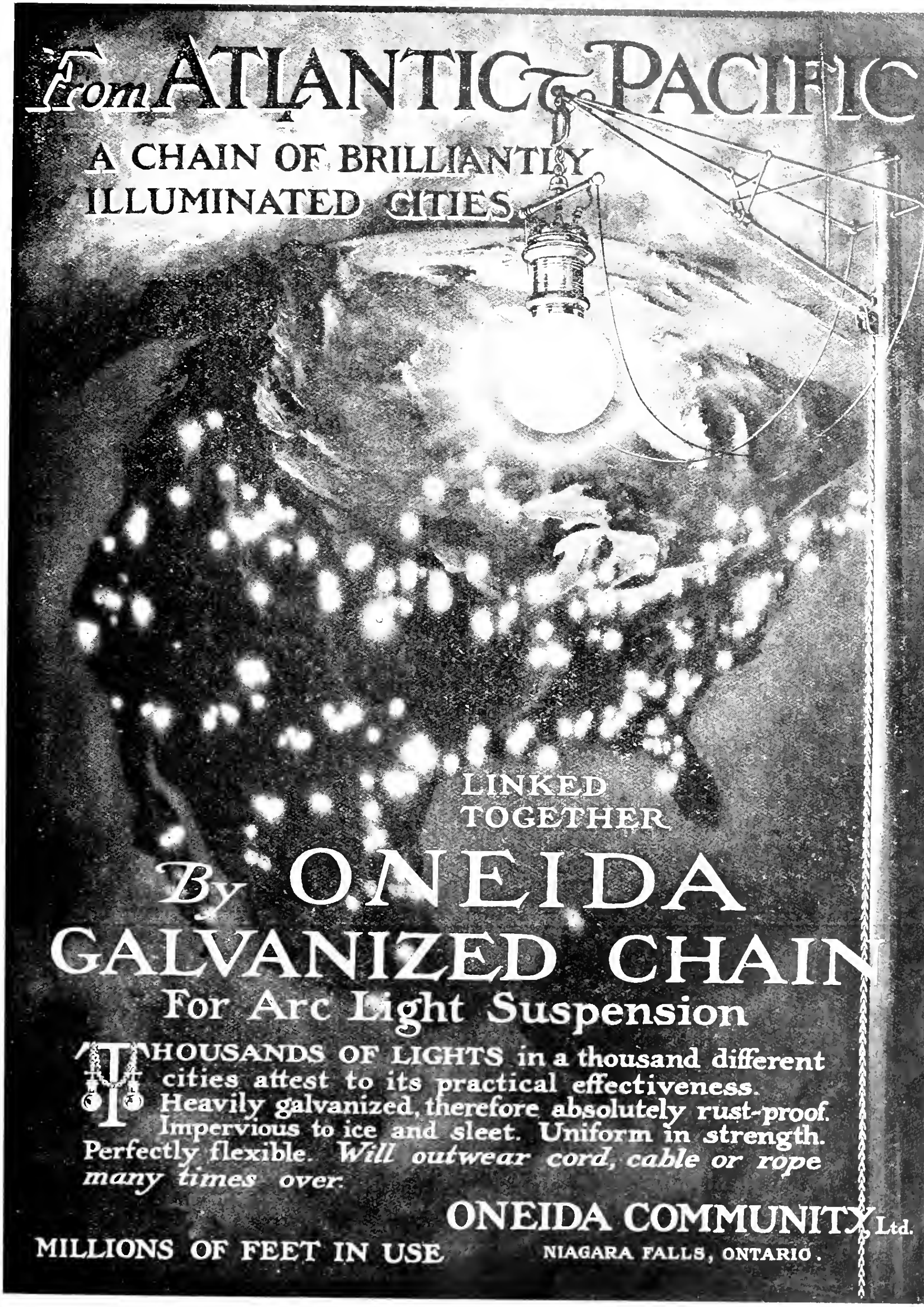


One of three 3,000 Kilowatt Armature Rings, built by The Electric Construction Co., of Wolverhampton.

No Order Too Large or Too Small. Send your Orders and Enquires to

GAS AND ELECTRIC POWER CO.

Main 7362 **123 Bay Street, TORONTO**


From ATLANTIC to PACIFIC
A CHAIN OF BRILLIANTLY ILLUMINATED CITIES
LINKED TOGETHER
By ONEIDA
GALVANIZED CHAIN
For Arc Light Suspension
THOUSANDS OF LIGHTS in a thousand different cities attest to its practical effectiveness. Heavily galvanized, therefore absolutely rust-proof. Impervious to ice and sleet. Uniform in strength. Perfectly flexible. Will outwear cord, cable or rope many times over.
ONEIDA COMMUNITY Ltd.
NIAGARA FALLS, ONTARIO.
MILLIONS OF FEET IN USE

Sparks

W. A. Mackenzie & Company, Toronto, were the successful tenderers for the issue of $85,000 debentures of the town of Indian Head, Sask., issued for waterworks, electric light and other purposes.

The Westmoreland Power Company are seeking incorporation to construct a street railway and to carry on a light and power business at Moncton, N.B. Reid McManus, Dr. C. A. Murray and J. A. Nile are interested.

The United Telephone Company, Russell, Man., have been granted a franchise to erect a rural telephone system throughout Silver Creek municipality. The company expect to commence work on the system this summer.

Further details of the Bull River Power & Light Company's plans at Fort Steele, B.C., are to hand. It is now stated that they will erect a power plant on the Bull river, near this place, and develop 10,000 h.p. The power house will be equipped with percussion waterwheels operating under a vertical head of 275 feet. George E. Henderson, of Merrillon, Wis., is manager.

At a recent meeting of the Wentworth County Council in Hamilton, application for a franchise to construct a line through Barton and Binbrook, touching at Hannon, Elfrida and Woodburn, was made by the Barton & Binbrook Independent Telephone Company. Application for a franchise to construct a line from Bullock's Corners to Copetown was also filed by the West Flamboro Telephone Company.

We are informed that the Cranbrook Electric Light Company have had plans prepared for a hydro-electric power plant to be built on the St. Marys river, eight miles from Cranbrook, B.C. It is proposed to install three units of 500 h.p. each, and in addition to supplying Cranbrook, it is proposed to construct transmission lines to Morgie and Marysville, distant twenty-five miles respectively. A. L. McCullough, of Nelson, B.C., is consulting engineer.

The Bell telephone system recently acquired by the Alberta Government includes the long distance lines from Edmonton to Calgary, to Macleod and Lethbridge, and from those cities to Cardston, along which are scattered seventeen toll offices. In addition there are sixteen exchanges, including those of Calgary, Lethbridge, Wetaskiwin, High River, Lacombe, Olds, Okotoka, Claresholm, Cardston, Raymond, Innisfail, Didsbury, Nanton, Ponoka, Red Deer and Magrath.

The Electric Distributing Company, Limited, head office, Toronto, Ont., has been incorporated with a capital of $100,000. The incorporators include A. G. Ross, M. L. Gordon, G. C. Loveys, W. Smith and W. S. Edwards, all of Toronto. At the same city are also the headquarters of the recently incorporated Friction Heat Light Company, Limited, capitalized at $60,000, whose incorporators include George Paton, James Linton, A. Laidlaw, Andrew Reading, and W. M. Hall, all of Toronto.

It is stated that the shareholders of the Stark Telephone, Light & Power Company, Limited, Toronto, which went into liquidation some time ago, may shortly be asked to subscribe to an issue of bonds equal to 40 per cent. of all their holdings. If the bonds are taken over by the shareholders it is felt that the indebtedness could be wiped off, the plant improved and sufficient working capital left to carry on the business. The plan of reorganization has been presented to the liquidator, E. R. C. Clarkson, for approval.

The Provincial Telephone Department of Manitoba has let the following tenders for supplies to be used in construction work this year: Wood side brackets, Northern Electric Company, Winnipeg; cross arms, E. Bissel & Sons, Toledo, Ohio, and the Northern Electric Company; top pins, Northern Electric Company; insulators, Northern Electric Company; copper wire, Wire & Cable Company, Montreal; copper sleeves, F. B. Cook, Chicago; weather proof iron wire, Canadian General Electric, Montreal; steel strand wire, W. E. Skinner, Limited, Winnipeg; pole line hardware, Northern Electric Company.

It is stated that an agreement has practically been reached regarding the new lines to be built by the Hamilton Street Railway Company. In the north end there is to be a line on Fernie street from James street to Emerald; in the southeast end the Wentworth street line is to be taken up and a line laid on Wellington street, Stinson street and Delaware avenue; in the west end the Herkimer street line is to be continued to Garth stret and the York street line is to be extended and improved. There is also talk of a line on Bold street, and some other extensions and changes are contemplated.

CANADIAN
ELECTRICAL NEWS
& ENGINEERING JOURNAL

PUBLISHED ON THE FIFTH OF EVERY MONTH BY
HUGH C. MacLEAN, LIMITED,
TORONTO, CANADA.

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362
MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative
WINNIPEG - - - - - - - - Telephone 224. 330 Smith St.
ROLAND F. HILL, Representative
VANCOUVER - - - Telephone 2248. 615 Hastings St.
GEO. A. GALL, Representative

ADVERTISEMENTS.

Advertising rates sent promptly on application Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.

The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

Maximum Demand Indicators.

Not so very long ago there was introduced to Canada and the United States, an instrument, known as the Wright Demand Indicator, which served the very valuable purpose of shewing the maximum load which had been passing through any given circuit since the instrument was last observed. It was first used in England, the home of the designer, who got it out in response to the call for some device which would show the maximum energy taken by any consumer into whose lines it might be connected. Conjointly with the production of the instrument Mr. Wright elaborated a system of power rates based on the principle that the cost of energy must necessarily be determined to quite an extent by the *maximum* requirements of each particular user, as well as by the size of his *average* load. The combination constituted a fairly successful attempt to systematically take care of the effect of load factor on the costs of power, load factor being the relation between the average output of a station, or the average consumption of any given circuit, as compared with the respective maximums.

Besides being a very valuable instrument when used with the foregoing object in view, the Wright Demand Indicator has also found quite a large field as a means of determining whether or no a certain apparatus was overloaded. For instance, it is more or less difficult to get satisfactory continuous readings of the load on pole type transformers by means of an ordinary ammeter, but a Demand Indicator, installed for a week or so, will show at a glance the maximum amperage passing through them.

As a somewhat more complete and most interesting instrument, there has lately been placed upon the market a polyphase maximum indicator, which in several respects is a great improvement over the original form, and an instrument which will doubtless fill certain conditions that could not be met by Mr. Wright's design. In the first place, the new form is self-contained and polyphase, so that only one meter is needed to get readings on either a two phase or a three phase circuit. Further, it reads in kilowatts, or horse power, not simply in amperes, so that it automatically looks after variations in voltage and in power factor. More than this, it is a continuously indicating instrument, in this respect being similar to the ordinary switchboard indicating wattmeter, in that it is equipped with a hand that moves over the scale in exact accordance with the power that is being consumed from minute to minute. The record for the maximum load that has passed is kept by a second hand that is interlocked with the first one so that while the two can move up the scale together, a ratchet prevents the maximum hand from moving back until released by the observer.

This instrument is not likely to be used to any extent for determining whether or no a given piece of apparatus is overloaded, because the Wright ampere meter, necessarily a much cheaper device, is perfectly satisfactory for that purpose, but it is very probable that central stations will find it exceedingly valuable as a means of accurately measuring the actual maximum power consumptions of their larger customers. It in this way forms another addition to our already pretty fair array of measuring instruments, doubtless some day we shall have a reliable two rate wattmeter at a reasonable price, and then the list will be complete.

Switchboard Design.

It would appear, judging from several instances which have lately come to our attention, that there is a great tendency at the present time to install switchboards which are far more elaborate than is warranted by the size of the balance of the equipment. On the other hand it must be acknowledged that such installations are but following the example of many large plants now operating or in course of construction, at the same time is it not proper that we should make an effort to differentiate between boards that are intended to control very large powers at very high voltages, and those where the corresponding quantities involved are very much smaller? In other words, does our present practice not frequently load up a comparatively small proposition with a board that is far too complete and consequently far too costly, failing to recognize that a much more simple construction would accomplish the required end equally well? As an illustration of this latter point, we have in mind a direct current board which was laid out with quick break knife switches, which, as they were fairly large, made quite an addition to the cost as compared with the plain form. But the board was also equipped with circuit breakers, which would naturally be used when a line had to be opened under load, consequently the switches became disconnecting devices, and as such could very properly have been made without the quick break attachment. Further, this would not only have lessened the cost, but would also have given the consumer a more rugged and substantial device. A much more aggravated instance was afforded not long ago by a motor installation in

a factory, the board for which, as at first specified, would have cost not far from \$3,000. When we are told that this figure was approximately 20 to 30 per cent of the cost of the motor themselves, it will at once be recognized that such an expenditure could scarcely be justified. Then again, take our almost universal practice of installing costly oil switches, even in plants containing but one generator, between this latter and the step up transformer. Surely this type of station affords a chance of making quite a saving by tieing the generator and the transformers solidly together, and doing all the switching on the high tension side. Of course there will be a number of plants where this cannot conveniently done, but on the other hand, it would seem as if there were many where it would be most advantageous, not only because of the reduction in first cost, but also because of the increased simplicity and the decreased maintenance charges which would result therefrom.

The above is, not meant for an instant to detract from high class switchboard construction as a most necessary and valuable accessory to any plant. The finest workmanship and material and design that money can buy are of course the really best investment, but the point is that good design is more frequently evidenced by simplicity than by the somewhat too complete boards which are frequently installed in situations where they can never show a proper return upon the investment.

The C.E.A. Convention.

Canada is so singularly blessed with water powers that doubtless it will soon become the scene of some of the largest electrical operations which the world will ever see. For instance, take the Niagara plants. They are already the largest hydraulic developments that have been executed, and doubtless to them will soon be added some exceedingly heavy electric traction by the electrification of the surrounding C. P. R. and G. T. R. lines. Equally sure is the electrical operation of the C. P. R. lines through Quebec and through the Rockies. Then again, turning to the question of electric smelting, is it not entirely likely that in a comparatively short time the enormous iron deposits in the northern parts of Ontario and Quebec will yield their wealth through the economies of electric smelting. Besides all this we have the natural growth of the electric lighting industry to look forward to, to say nothing of the revenue to be found from stationary motors.

In view of these wonderful natural resources, which are at once the amazement and the envy of almost every visitor accustomed only to conditions elsewhere, does it not behoove every operating company to see that it is well represented at the forthcoming C. E. A. Convention, and is it not equally incumbent upon every representative to see that he earnestly and conscientiously joins in the business of the meetings? Further, it is the duty of operating companies to bear the expenses of their representatives. Nothing but an association can properly nurture and further the interests of the central station, which within limits are the same from one end of the country to the other. Why,then, not use to the fullest possible extent those benefits and privileges which the C. E. A. alone can offer you? All it asks of you is to come to the convention and to attend faithfully to your own personal share in the proceedings, not leaving the questioning and the answering and the other speaking to be all done by a small section of those present. It will do the rest.

We think that the Paper Committee is to be congratulated upon the general tenor of the programme which it has laid out for the 1908 convention, because, judging from their titles, the papers to be delivered will be even more markedly commercial than were those given in Montreal last September. These latter marked quite a change from those previously presented in that they touched more upon the business than upon the purely technical side of electrical operations, and as such were undoubtedly very welcome and very valuable, for instance, while a discussion upon the methods of constructing the machines in a plant is most advantageous, the details of management are even more important. It is most desirable that the Association engender a spirit of co-operation among its members, but a still greater work for it is the cultivation of friendly relations between each and every member company and the public, whom they serve. The relations between the central station and the Underwriters, the question of rates, the conditions surrounding franchises, the responsibility for accidents, these all are matters waiting for *you*, to do your individual part towards getting them into the best proper shape. Resolve then to be an attendant at the 1908 Convention of the C. E. A., which is to be held in Toronto, on June 17th, 18th, and 19th, and come purposed and prepared to take a full and lively interest in all the questions which come before it.

Direct Reading Chemical Meters are Legal.

The following letter has been received from Mr. Ormond Higman, of the Electrical Standards Laboratory, Ottawa:

"I beg to call your attention to an inaccuracy in your answer to question No. 3 in the May issue of the "Electrical News," wherein it is stated that "Chemical meters are not legal in Canada, as they are not direct reading, except that any that are in use may be retained, though no new ones may go in.'

"It may be stated that there are several electrolytic meters in use that are direct reading and among the number may be mentioned the Wright, the Mordey-Fricker, the Holden and the Bastian, the latter having been admitted to verification in Canada many years ago, are now being used on several direct current systems in this country. With reference to chemical meters generally it may be stated that they depend on the chemical action of a current of electricity when passed through certain liquids, such as dilute acids and solutions of metallic salts. Under these conditions a chemical decomposition takes place. The amount of decomposition depends on the strength of the current, the time interval during which the current flows and the nature of the electrolyte, or in other words on the electro-chemical equivalent of the substance liberated. Hence it is that meters of the Bastian type are direct reading and may be used in Canada when approved by the Department of Inland Revenue. The old Edison chemical meter is not direct reading and may not be retained under any circumstances."

A torpedo invented by Grendell Matthews is claimed to be controllable absolutely up to a considerable distance and to be capable of being exploded at any moment desired by means of wireless electricity. No connection to guide the instrument is necessary between it and the torpedo boat from which it is discharged. The inventor also asserts that he has discovered an electrical wave which cannot be interfered with.

Annual Meeting of Toronto Section A.I.E.E.

The May meeting of the Toronto Section of the American Institute of Electrical Engineers was held on May 15th. This was made the annual meeting of the Section. The report of the secretary was adopted. It showed that the expenditure had been $130.65.

A motion was carried extending to the family of the late H. L. Price the sympathy of the Section with them in their bereavement.

Mr. Price was a graduate of McGill University, and had been employed in Mexico before taking up work in Canada. He joined the American Institute of Electrical Engineers in January of this year and had been a regular and interested attendant at the luncheons and meetings.

The executive committee for the next season was appointed as follows: Chairman, W. A. Bucke; vice-chairman, H. W. Price; secretary, W. G. Chace; executive committee, E. Richards, W. H. Eisenbeis, M. J. Clark.

The chairman announced that the convention of the Institute will be held at Atlantic City, N.J., from June 29 to July 2.

K .L. Aitken, Retiring Chairman Toronto Section A.I.E.E.

The members of the Section then visited the main and College exchanges of the Bell Telephone Company, and were courteously received and accompanied by Messrs. Patterson and Moffatt, who exercised every care that the visitors should gather as thorough a grasp of the present state of the art and its development as the brief time would allow.

Mr. Wm. A. Bucke, whose portrait appears on another page along with those of other officers of the Canadian Electrical Association, was appointed chairman of the Toronto Section of the American Institute of Electrical Engineers, at its annual meeting last month. Mr. Bucke graduated from the School of Science in 1894 and took a post-graduate course the following year, obtaining the degree of Bachelor of Applied Science in 1895. The following February he joined the staff of the Royal Electric Company in Montreal, and was placed in the electrical testing department, of which a little later he was appointed foreman. He afterwards was on outside construction for a year or two, and in the summer of 1900 joined the selling staff.

Upon the completion of the purchase by the Canadian General Electric Company of the Royal Electric Company in January, 1901, Mr. Bucke was offered a position on the selling staff of this company, and has been attached to the Toronto district office ever since, having been appointed manager of the office a year ago.

The retiring chairman of the Toronto Section of the A.I.E.E., Mr. K. L. Aitken, has earned the thanks of the members for his devotion to the Institute. Mr. Aitken has been prominent in the affairs of the Section since its inception some years ago. He has presented several papers before the Section and also before the Canadian Electrical Association. Mr. Aitken is a most successful consulting engineer.

The contract between the Hydro-Electric Power Commission of Ontario and the City of Toronto for the delivery of 10,000 h.p. at $18.10 per h.p. has been signed by Mayor Oliver. The Toronto Board of Control recently published the following figures in regard to the cost of power under this contract: Estimate cost of construction of transmission line, $3,160,000; Toronto's share, $828,080; estimate cost of maintenance, line loss, repairs, etc., $139,883; Toronto's share, $38,970.

The following estimates have been drawn up for other cities and towns:

	Horse-Power Wanted.	Transmission Line. Construction.	Maintenance.
Toronto	10,000	$828,080	$38,970
Hamilton	1,500	115,650	5,442
London	5,000	671,080	31,578
Brantford	1,500	172,770	8,134
Guelph	2,500	347,420	16,350
Stratford	1,500	215,600	10,146
St. Thomas	1,500	244,140	11,490
Woodstock	1,200	155,350	7,310
Berlin	1,000	138,970	6,540
Galt	1,200	143,920	6,773
Hespeler	400	63,200	2,974
St. Marys	1,500	287,000	13,506
Preston	600	80,530	3,789
Waterloo	685	98,460	4,630
New Hamburg	250	47,830	2,251

Preston and St. Thomas and Woodstock have also signed contracts with the Commission.

James Ryan, Superintendent of the Shawinigan Water & Power Company, and H. Racine, laborer, were drowned at Shawinigan Falls recently. Supt. Ryan started out, as was occasionally his practice, to visit the different parts of the water course, which fed the generating plant of the company. Accompanying him was his assistant, Racine. The boat had covered almost the same course many times before, but this time it was caught in the swift running water and swept over the falls, which are 120 feet in height. James Ryan was 35 years of age and a resident of Shawinigan Falls, where his wife survives him. He had been in the employ of the company for over four and a half years. He was considered one of the brightest and most valuable of the men at the Shawinigan works, having worked up in less than five years from helper to superintendent.

Electrical Equipment of the Traders Bank, Toronto

Power and Lighting Plant in Toronto's Largest Office Building

The power plant of the Traders Bank Building of Toronto, presents a most interesting exhibit of all that is modern in the generation and distribution of power and lights to a large office building. The Traders Bank Building being the largest office building in the British Empire naturally becomes one of the prominent sights of the city and a short description of this power plant will doubtless be found interesting.

The power plant is located in the basement of the main building and has a normal capacity of 335 kw. Owing to the location of the plant the question of floor space is a most important one, the available floor space being of course limited.

The many advantages of the double voltage or 3-wire system of distribution for lighting and power in an installation of this nature are at once apparent. With the adoption of this system a saving of 25 per cent. of the weight of copper in the feeders, when figured on a basis of current capacity, is obtained, and a saving of 62.5 per cent. when figured on a basis of drop in potential. This system also makes available the 220 volts for the motors and 110 volts for the incandescent lighting, both the lamps and the motors being taken off the same feeders.

Aside from these features the adoption of the 3-wire type of generator with balancing coils, together with the vertical type of engine to be described later, resulted in a most decided saving in floor space, which, as previously mentioned, was a most important consideration.

The generating equipment consists of two 150 kw., 250-125 volt, compound wound, Westinghouse direct current engine type 3-wire generators, direct connected to two 225 h.p., 14 x 21 x 12 Robb Armstrong cross compound vertical enclosed engines, operating at 275 r. p. m. with 150 pounds of steam. The valves are balanced and of the double ported type, and controlled by the Robb-Armstrong-Sweet governor, which gives extremely close regulation. The engine shaft is a solid steel forging throughout, with balanced cranks. The oiling system consists of a positively driven pump, which draws oil from a reservoir in the base, and distributes it through a double system of piping under pressure of fifteen to twenty-five pounds per square inch to every bearing. These units are well illustrated in Figs. 1 and 4.

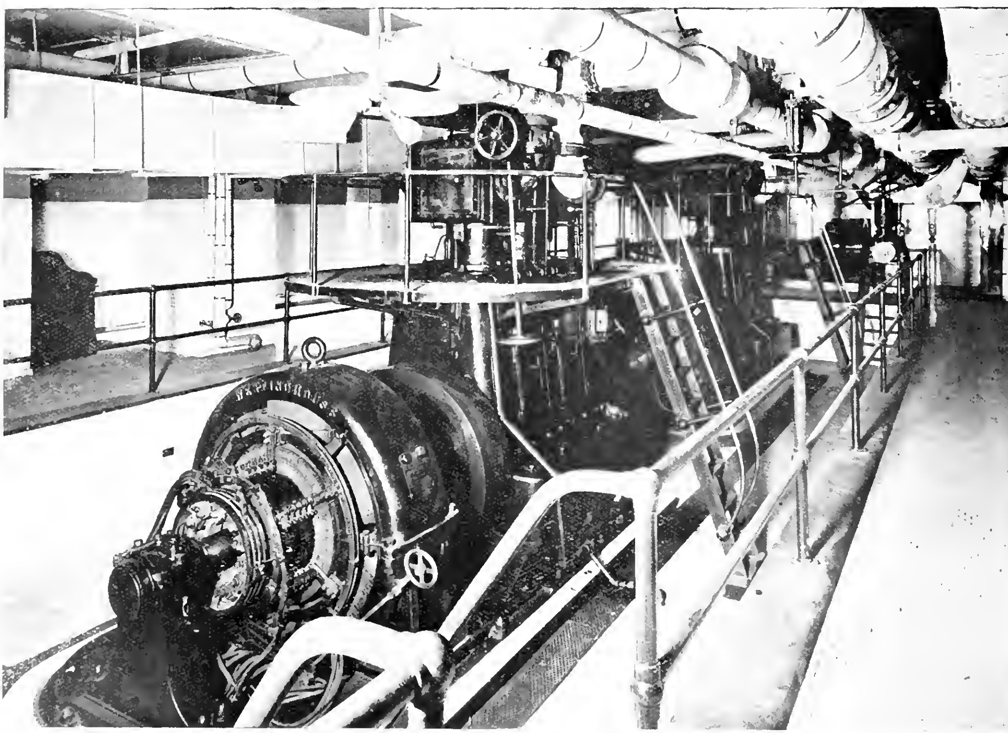


Fig. 1. Traders Bank Plant. Two 150 K. W., 250-125 Volt Westinghouse Generators.

The 3-wire generator mentioned consists of a standard 250 volt 2-wire machine with the addition of four slip rings mounted on the shaft and connected to the armature windings at intervals corresponding to 90

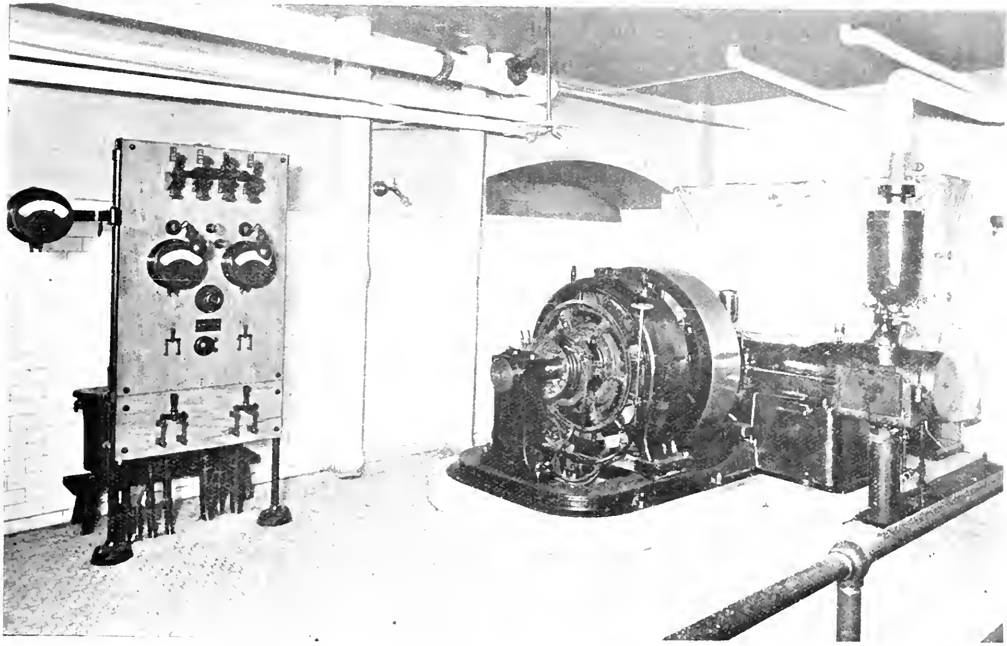


Fig. 2. Traders Bank Plant. Auxiliary 35 K.W. 250-125 Volt Westinghouse Generator and Switchboard.

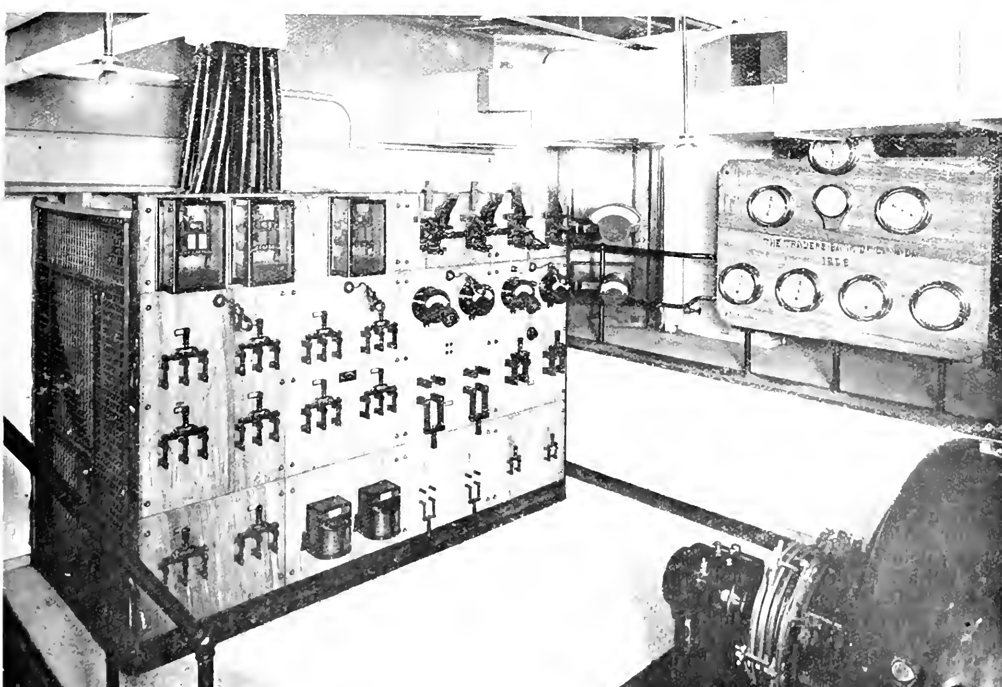


Fig. 3. Traders Bank Plant. Main Power and Lighting Switchboard.

electrical degrees. The voltage at the slip rings is 2-phase alternating. The current is taken from the slip rings to a pair of balance coils, one coil to each phase. Each balance coil has a neutral wire connected to its winding midway between the ends. These are connected together and form the neutral of the 3-wire direct current system. The two main leads only are carried through the switchboard proper, as will be described later, the neutral wire being taken direct to the balance coils and from there to the feeders. With these additions to the standard 2-wire generator a voltage of 110 volts becomes available on either side of the neutral for the lighting circuits.

In this installation, mention might be made of the engine and generator foundations, which are only twenty-four inches deep, laid on four inches of sand

direct connected to a 10 x 10 Robb Armstrong horizontal side crank engine, and is supplied with an independent switchboard for its control. The complete unit with its controlling switchboard is shown in Fig. 2.

Each of the three units, as previously mentioned, is equipped with 2 balancing coils of ample size to permit of an unbalance of 25 per cent. on either side of the neutral. These coils are not indicated on the accompanying illustrations, being located at the rear of the switchboards.

The main power and lighting switchboard is shown in Fig. 3. Panels No. 3 and No. 4 each control one 150 kw. generator. Panels No. 1 and No. 2 are the feeder panels.

As the series field coils of the 3-wire generator are divided in halves, one half being in each side of the

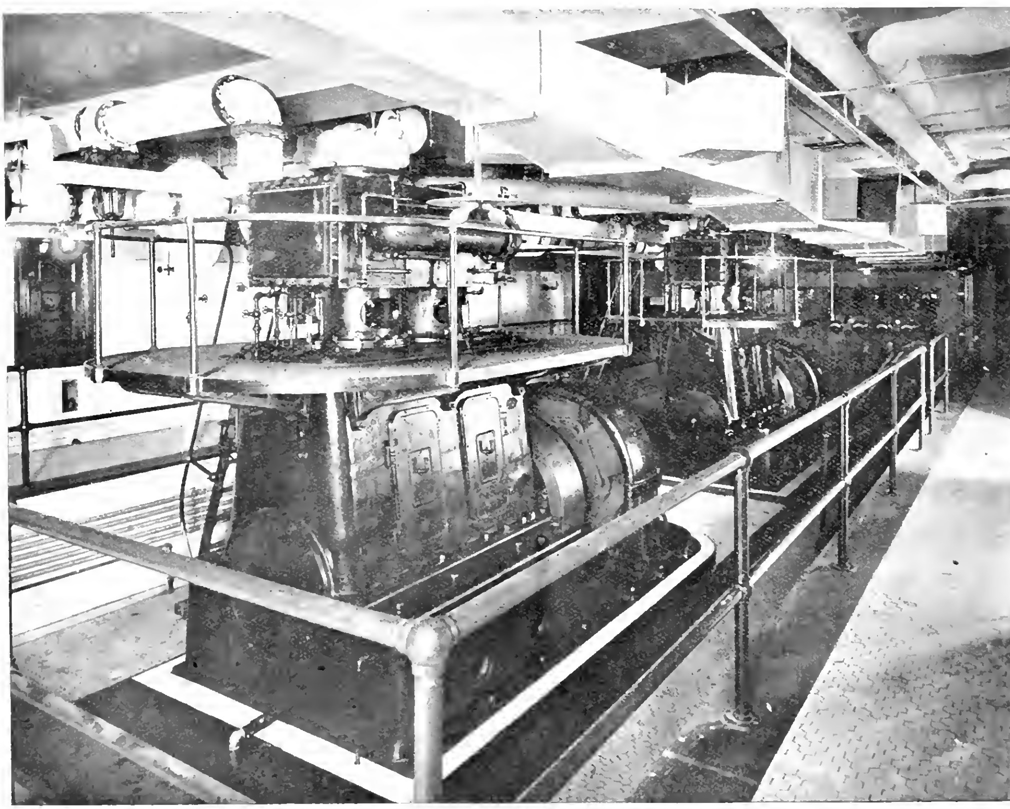


Fig. 4. Traders Bank Plant. Two 225 h.p., 14 x 21 x 12 Robb Armstrong Engines.

to prevent vibration. At the same time there is no perceptible sign of movement either in engine, generators or piping.

In addition to the larger units, a small auxiliary plant is located at one end of the generating room. This unit is used at periods of light load, in the winter between seven and nine a.m. and after 6 p.m., and in the summer during the most of the day, also on holidays, etc.

This unit consists of a 35 kw., 250-125 volt, 3-wire Westinghouse direct current engine type generator,

circuit in order to properly compound should any unbalance exist, the protective devices and measuring instruments require special consideration.

In the switchboard, each generator panel is equipped with two single pole circuit breakers with special equalizer contacts to insure the opening of all circuits in case of excessive load or short circuit. Two ammeters are essential for use with each generator as indicated on the illustration, so that the load on both sides of the system may be observed and any unbalance noted.

In addition to these instruments two main double pole single throw switches are supplied, one for each main lead with its equalizer. On the sub-panel of these boards will be noted two 2 pole single throw switches, which are connected to the balance coils to disconnect them in case of accident. On the extreme end of the board are mounted two voltmeters. The upper illuminated dial type is connected direct to the bus bars. The lower voltmeter is connected through the four point voltmeter receptacles provided on the panels to either generator. It is necessary to thus supply two voltmeters to provide a means of paralleling.

There is installed on feeder panel No. 2 on the upper panel a 1,500 ampere 250 volt recording wattmeter to register the total load from the bus bars. Three pole main feeder switches are provided for the control of the various feeders in the building, there being 10 main feeder circuits. These are grouped into four sets of feeders, each set being taken through a recording wattmeter of proper size to register the wattage of each circuit. Two of these meters are shown on the sub-base of panel No. 2. The other two are mounted in the upper panel on panel No. 1. All the feeder circuits to the building pass direct from the rear of this switchboard to proper conduits in the ceiling, as shown on illustration. The main three-wire feeders are carried to junction boxes, one on each of the various floors, from which point the 2-wire 110 volt lighting distribution is made as well as the 250 volt power circuit where required.

The small switchboard for control of the 35 kw. unit is located at the other end of the power plant. The voltage from the main bus bars of the main control board is carried direct to this switchboard, the current of the generator being carried through its control switchboard to the bus bars of the main switchboard, at which point it is recorded at the wattmeters and then distributed to the building. There are, therefore, no feeder switches on this small panel, but it is equipped with the necessary circuit breaker with equalizer contacts, together with ammeter and main switch for each main lead. The illustration of this board also indicates the method of locating the balance coils at the rear of the switchboard panel.

The entire equipment has been in operation for a period of over a year and has been in thoroughly successful operation during the entire period, under the supervision of Mr. J. Ross, chief engineer. Every detail in the engineering and mechanical layout has received thorough and careful consideration, and the equipment in its present shape presents a type of the highest grade of engineering throughout. The entire contract was undertaken by the Canadian Westinghouse Company of Hamilton, Ontario. The switchboards and generators were supplied by this company; the engines by the Robb Engineering Company of Amherst, N.S.

Arrangements for Marseilles Congress.

At the International Congress of the Applications of Electricity, to be held at Marseilles, France, from September 14 to September 21, the followings sections have been arranged for: (1) Regulation, (2) Construction and Protection of Electric Systems, (3) Construenical and Commercial Operation, (4) Lighting and Domestic Applications, (5) Applications to Industry, Mines, Traction and Agriculture, (6) Electro-Chemistry and Electro-Metallurgy, (7) Telegraphy and Telephony, (8) Teaching and Measures, (9) Applications to Hygiene and Medicine.

Vancouver's City Electrician.

Mr. Robert L. McCulloch, city electrician of Vancouver, is a Scotchman, having been born in the city of Glasgow. His earlier experience was gained in engineering shops on the Clyde, where he was associated for several years with a well-known maker of high speed engines. Mr. McCulloch is a graduate of the West of Scotland Technical College, and upon graduation accepted an appointment with a large firm of electrical contractors. He next became assistant to the resident engineer on the Clyde Valley Electrical Power Company's scheme, an undertaking supplying power to a district of over 730 square miles, comprising the large coal and iron area of Lanarkshire, and the busy manufacturing districts of Renfrewshire and Dumbartonshire.

On the completion of construction work on this

Robert L. McCulloch, City Electrician of Vancouver.

scheme Mr. McCulloch went into business for himself as consulting and manufacturing engineer, but withdrew from this business to accept a lucrative appointment in Western Canada.

Mr. McCulloch was appointed city electrician of Vancouver in November last, and has made himself generally respected there by his careful handling of the work over which he has charge.

The Harpell-Stokes, Limited, Winnipeg and Toronto, are equipping a factory for the manufacture of the Victoria Potato Peeler, which is direct connected to an electric motor and can peel a barrel of potatoes in six minutes.

Mr. H. H. Henshaw, former secretary of the Montreal Light, Heat and Power Company, died suddenly at St. Hyachinthe, Que., on May 15.

Canadian Electrical Association Convention

At time of writing arrangements are practically completed for the eighteenth annual convention of the Canadian Electrical Association, to be held in Toronto, June 17th, 18th and 19th. The convention headquarters will be the Chemistry and Mining Building of the University of Toronto, which possesses excellent facilities for the meeting. The building, which can be conveniently reached by two lines of street cars, the College, and Bloor and McCaul, is spacious and well lighted and ventilated.

A feature of the convention this year will be an exhibit of electrical apparatus on a larger scale than heretofore. While this exhibit will be confined to the smaller apparatus and supplies, it will be none the less interesting on that account. Mr. Saul Dushman will give a practical demonstration of electro-metallurgical apparatus.

R. S. Kelsch,
President Canadian Electrical Association

The papers to be presented number fourteen, four of which will be illustrated by lantern slides. Many of the papers are commercial in character and such as should interest all persons who have to do in any way with the sale of electricity for lighting, heating or power purposes. No question is of more vital interest to the central station manager to-day than that of procuring the most profitable load for his plant. On others he may depend for the perfection and efficiency of apparatus, but on him devolves the duty of securing and retaining a line of customers which will enable his machines to be operated at the maximum of economy and build up a stable business. The discussion of subjects of this kind at the forthcoming convention should in itself attract a large attendance.

The committee have been working zealously for the success of the convention, and, in addition to the business program, have arranged a number of entertainment features, including a baseball match between the manufacturers and operating companies. Everything points to a good convention, and every member should endeavor to attend.

The Local Committee is as follows: R. G. Black (Chairman), W. N. Ryerson, J. J. Wright, T. J. Lynch, W. A. Bucke, T. F. Dryden, W. G. Chace, W. H. Eisenbeis, J. A. Kammerer, W. B. Boyd, D. H. McDougall, C. H. Mitchell, H. A. Moore, R. J. Clark, G. K. Hyde, T. S. Young.

PROGRAM

WEDNESDAY, JUNE 17.

9.30 a.m.—Meeting of Managing Committee.

10.30 a.m.—Opening Session.
Minutes.
President's Address.
Secretary-Treasurer's Report.
General Business.

11.30 a.m.—"Power Rates and Factors Which Influence Them," by W. N. Ryerson.

Afternoon Session.

2.00 p.m.—"How to Increase the Station Load," accompanied by lantern slides, by Mr. George Williams.
"Lost and Unacounted for Current," by Mr. C. R. McKay.
"Electrical Plant Earnings Per Capita," by Mr. W. A. Bucke.

Evening.

7.30 p.m.—"Various Electrical Power Plants by European Designers," full illustrated with slides, by Mr. C. H. Mitchell.

9.30 p.m.—Steamer will leave Yonge street dock for outling on the lake.

THURSDAY, JUNE 18.

10.00 a.m.—"Modern Arc Lighting," by Mr. A. E. Fleming.
"Regulation of Electric Currents or Circuits," by by Mr. W. G. Chace.
"Various Distributing Systems Adaptable to Cities and Towns," by Mr. R. G. Black.

Afternoon Session.

2.00 p.m.—"Electrical Franchises, Their Legal Status and Basis of Valuation, by Jas. Bicknell.
"Contracts," by Robert McKay.
Question Box.

4.30 p.m.—Executive Session.

3.30 to 6.30 p.m.—University Science Building open for inspection.

4 to 6 p.m.—Demonstration of electro-metallurgical apparatus, in the Chemistry and Mining Building, by Mr. Saul Dushman.

5.00 p.m.—Tea for the ladies at the Royal Canadian Yacht Club, Island Park.

Evening.

7.30 p.m.—Special cars will leave Queen's Hotel at 7.30 sharp for Scarboro Beach Park.

FRIDAY, JUNE 19.

10.00 a.m.—"Grounding of Transformer Secondaries," by W. L. Macfarlane.
"The National Electrical Code," by Mr. H. F. Strickland.
"The Oscillograph," illustrated with slides and instrument, by H. W. Price.
Naming of Standing Committees.
Next Place of Meeting.
Unfinished Business.

Afternoon Session.

1.00 p.m.—Association luncheon, followed by illustrated lecture, "Large Power Plants of America," by Mr. R. J. Clarke.

3.00 p.m. Boat for Hanlan's Point.

3.30 p.m.—Baseball match at Maple Leaf Park, Hanlan's Point, "Manufacturers versus Operating Companies."

W. A. Bucke

C. H. Mitchell

J. A. Kammerer

W. H. Eisenbeis

W. N. Ryerson

R. G. Black, Chairman

J. J. Wright

W. B. Boyd

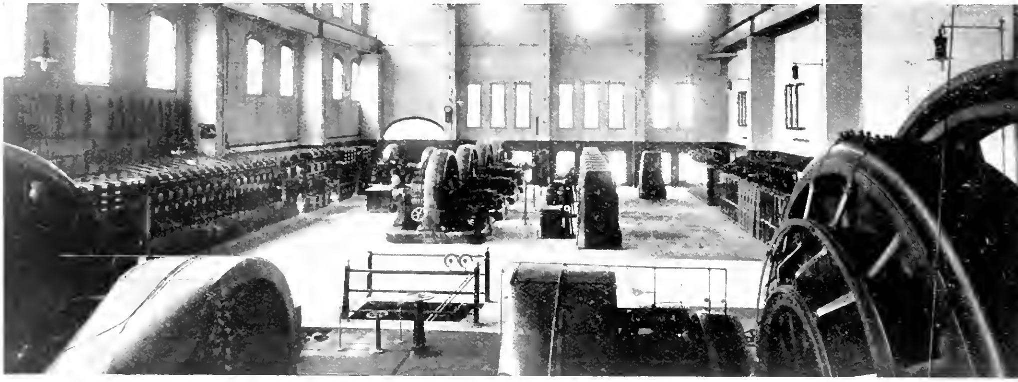
W. G. Chace

R. J. Clark

G. K. Hyde

SOME MEMBERS OF THE LOCAL COMMITTEE, CANADIAN ELECTRICAL ASSOCIATION CONVENTION

How the Toronto Railway Company Utilizes Niagara Power



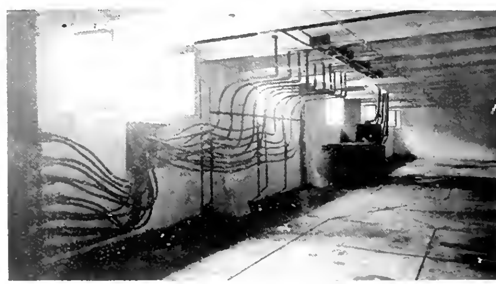
No. 1 Sub-Station Toronto Railway Company. Four 1,000 k.w. C.G.E. Rotaries.

The Toronto Railway Company operate their entire system of over 26,000 horse-power exclusively from energy supplied by the Toronto & Niagara Power Company, whose transmission line covers a distance of 83 miles. Energy is delivered at 60,000 volts to a terminal station on the city limits, and from this point is delivered to the three-substations of the Toronto Railway Company at 12,000 volts.

The three sub-stations are situated in different parts of the city in the best centres to meet the demands of the service, and are independently supplied with Niagara power, but are "tied" together by D. C. feeders. This arrangement has proven most satisfactory. Any one of the three sub-stations can operate the whole system when convenient, as during the early morning load; or any sub-station can help out another if required.

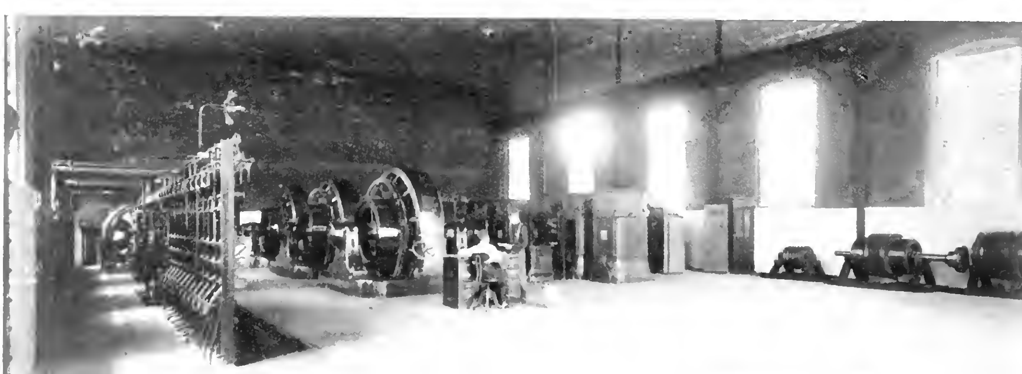
The Toronto Railway Company have not been called upon to operate any portion of the large steam units for over 18 months. During this period only one interruption has resulted from Niagara power and in this instance the interruption was of only very short duration. D. C. voltage is maintained on the system of the Toronto Railway Company at the minimum of 520 volts at any point on the lines with heaviest loads, a result which speaks volumes for "Niagara power" and an efficient D. C. feeding system.

Number 1 sub-station is situated on Front street, near Sherbourne street. This station is equipped with four

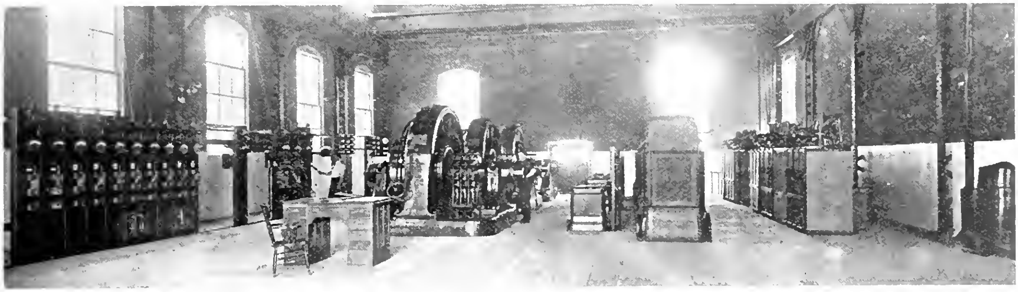


Positive and Negative Cable Compartment, No. 3 Sub-Station, Toronto Railway Company.

of the Canadian General Electric Company's 1,000 kw. rotary converters with the necessary transformers, A. C. and D. C. panels, etc. Three 12,000 volt No. 0 three conductor cables enter this station from the terminal



No. 2 Sub-Station Toronto Railway Company. Three 1,000 k.w. C.G.E. Rotaries.



No. 3 Sub-Station, Toronto Railway Company. Three 1,000 k.w. C.G.E. Rotaries.

Compartment directly under Rotaries, No 3 Sub-Station, Toronto Railway Company.

station of the Niagara Power Company. The transformers, which are of the single phase air blast type, step down from 12,000 to 410 volts. The six phase, 250 r.p.m., 600 volt, shunt wound rotary converters take the current at 410 volts A. C. and generate D. C. at 600 volts.

A chloride accumulator having a discharge rate of 3,000 amperes is also a part of the installation at number 1 sub-station. The battery affords excellent regulation. The regulation of the battery booster is controlled by a carbon regulator operated by changes of current in the supply line. Slight fluctuations in current cause the battery to charge or discharge and thus keep the incoming A. C. current constant.

Number 1 sub-station also supplies energy for a 25 cycle lighting and induction motor system. The current is taken direct from the 12,000 volt line and transformed down to the required voltages by oil-cooled transformers. The lights of this system are in the company's general offices, car building shops, car barns, etc., while the induction motors operate all constant speed machinery.

A 32 panel switchboard, from which all the equipment, D. C. sections and battery are controlled, was furnished by the Canadian General Electric Company, Peterboro, Ont.

Number 2 sub-station is situated on Yonge street,

12,000 Volt Compartment, No. 3 Sub-Station Toronto Railway Company.

Air Chamber Compartment, No. 3 Sub-Station Toronto Railway Company.

several blocks north of Bloor street, and is equipped with three Canadian General Electric Company 1,000 kw. rotary converters, the same as those installed at Number 1 sub-station. A 3,000 ampere battery is installed at number 2, as well as 18 switchboard panels.

Number 3 sub-station is situated in the western part of the city, on the corner of Dovercourt and Harrison street. This station has an equipment, with the exception of the storage battery, the same as number 2 substation.

One of the accompany cuts shows the rail bonding

Bonding Cars at work on Bloor Street, Toronto Railway Company.

cars at work on Bloor street. The Toronto Railway Company have adopted as a standard the improved method of electrically brazing a flexible copper bond to the rail joints, the function of which is to join the ends of the rails so as to form an unbroken circuit through them for the return current. The bonding cars are the product of the Electric Railway Improvement Company, Cleveland, Ohio.

A Good Word for Producer Gas.

The subject of Producer Gas vs. Hydro-Electric Power is engaging considerable attention, particularly in the Province of Ontario. In commenting upon the report of the Hydro-Electric Commission of Ontario, Mr. L. G. Read, Managing Director of the Colonial Engineering Company, Limited, Montreal, pointed out that the report was good evidence in favor of Gas engines—82 per cent. of the gas engine plants visited by the Commission's engineers operating satisfactorily—although the report did not so state—the remaining 18 per cent. classed as "failures," being attributed mainly to inexperience or bad judgment on the part of the builder or the purchaser.

The Hydro-Electric Commission has heralded the very low cost of $10.10 per h.p. at the Falls. This is certainly cheap power, but with water-wheel loss, generator loss, over all transmission losses, step down losses and motor loss, the cost of the power on the consumer's line shaft reaches a point where it cannot begin to compare with the cost of a like amount of power produced for the same consumer by a gas engine.

From a municipal point of view—a municipality contracting with the Hydro Electric commission for a stated amount of power—the power is delivered to the municipality at its city limits and the municipality must provide the distribution system and distribute this power to the consumers. To do this at a price which would insure against a deficit the municipality would have to charge the consumer a price which compared with gas engines would be prohibitive.

Mr. Read has demonstrated in a number of public addresses delivered in Ontario, that Toronto, London, Stratford or any of the other principal taowns could not sell Hydro-Electric current to the individual consumers for a price less than the equivalent of $50 to $60 per annum per horse power.

The Colonial Engineering Company has installed and handed over to the owners in operation, in the Dominion of Canada, five gas engine plants—Queen City Printing Ink Company, Toronto 50 h. p., Kingsbury Footwear Company, Montreal, 90 h. p., Anchor Fence Company, Stratford 40 h. p., Empire Manufacturing Company, London, Ont., and Dominion Brewery, Toronto, and in every case the plants have more than made good. The best evidence of this is that four of the five plants have been accepted and paid for by the owners. In addition to these the Colonial Engineering Company has just started a 200 h. p. plant for Ames Holden Limited, the well known shoe manufacturers, Montreal, and a 200 h. p. municipal electric lighting plant for the City of Chatham, Ont., and in both these cases also the engines have started without a hitch of any kind.

Toronto's Proposed Distribution Systems.

Messrs. Smith, Kerry & Chace, consulting engineers, Toronto, have sent the following offer to the Toronto Mayor and Board of Control:

"In reference to the construction of your municipal electrical distribution stations and system, which we understand you are now proposing to undertake, we respectfully submit an offer to take charge of and carry out the detailed designs, plans, specifications, forms of tender, etc., for the same at a rate of 1½ per cent. of the estimated cost of the construction; and in the event of the city contracting for and carrying out the construction of this work, we are prepared to give continuous superintendence, including the cost of the inspection of the machinery during the process of manufacture at the factories and inspection of all the building of the conduit systems, at a rate of 4½ per cent. of the cost of the work. The said 4½ per cent. to include the 16 per cent. already quoted on the designs and specifications.

"Should you favor us with an order to carry on this work as above outlined, we would request that some arrangement be made by which advance payment could be made to us from time to time in sufficient amounts to at least meet our running expenses, as a two-year undertaking would have to be carried by us otherwise until the completion of same."

Mr. Alex. Dow, electrical engineer, who was consulted recently by the city regarding the construction of the power distribution plant, has recommended the names of Mr. C. B. Smith, of Smith, Kerry & Chace, consulting engineers; Prof. R. B. Owens, of McGill University, and Mr. L. A. Ferguson, of Chicago, president of the Institute of Electrical Engineers of America. For the office of engineer-in-charge, Mr. Dow says that he thinks favorably of Mr. W. G. Chace, who has been recommended for the post by the City Engineer.

Mr. Dow says that he would prefer to remain off the board, but should the city insist on having him, his fee would be $50 a day, with an additional retainer of $1,200 a year.

Mr. Fred Hoffmeister, formerly with the Canadian General Electrical Company of Ontario, has been visiting his brother, Mr. R. Hoffmeister, in Vancouver.

National Electric Light Convention.

The thirty-first convention of the National Electric Light Association was held from May 19 to 22 at the Auditorium Hotel, Chicago, the city that witnessed the birth of the association more than a score of years ago. From the outset a large attendance was assured and the total was about 1,500. Among those present were several past presidents, including Messrs. Insull, Doherty, Blood, Ferguson, Davis, Ayer, Huntley, Edgar and Williams.

Great interest was taken in the visit to the Fisk street plant of the Commonwealth Edison Company. The plan put in effect this year of having the erection of exhibit booths and the delivery of goods in the hands of an exhibition committee, which contracted for the work and handled it in a systematic way, worked with remarkable smoothness and saved exhibitors much worry.

The first session opened on Tuesday morning at 11.40. President Farrand's address referred to the increasing importance of the association for good or ill. Active members now number 664 in class A, 394 in Class B and 151 in class D. The increase in the year is 10 per cent. The old question box, he stated, was inefficient and slow. The monthly bulletin of the association was started last August with eight pages to answer questions and for other matter. It has since grown to 16 or more pages and costs less than the old yearly question box, and is more satisfactory.

Following are abstracts of several of the papers read and reports presented:

The report of the Committee on Progress, Mr. T. C. Martin, chairman, was devoted to a review of the events and developments of the year. It showed that for the first time in its history the association has over 5,000 central station systems to draw upon for membership.

Gas Engines Successful.

The committee on gas engines, consisting of Mr. Wm. C. L. Eglin, chairman, and Messrs. J. E. Klumpp and I. E. Moultrop, presented a report dealing with the more important points concerning the design, features and operation characteristics of modern gas engines and producer plants. Although the committee was unable to present any definite figures as to efficiencies, it stated that the efficiency of a combined gas engine and producer is higher than that of a combined plant of steam boiler and engine, and the former must command the attention of all companies using fuel for producing electrical energy. The mechanical features of gas engines have been so simplified that continuous operation can be expected with no more attention than that given to steam engines of equal rating. Gas engines are now being operated in nearly every field occupied by the steam engine. The committee stated its belief that gas engines will be used with increasing satisfaction in central station work. Gas producers have not reached the stage of development attained by the gas engine.

Low Pressure Steam Turbines.

The combination of a high pressure steam engine exhausting into a low pressure turbine and the latter exhausting into a condenser was treated in a paper by Mr. J. W. Kirkland. The author claimed that this arrangement will improve the performance of many existing steam engine stations, that have heretofore been uneconomical, to such an extent as to make them compare advantageously with many more modern and larger stations. While the best net economy of a combination of engine and turbine will be gained when the engines used are most efficient, the gain by the use of low pressure turbines will be such as to produce very satisfactory saving in connection with engines of poor economy.

Test results were reported to show that by combining a low pressure turbine with an existing steam engine, the combination using 50 per cent. more steam than formerly, the output may be increased by 100 per cent.

Accuracy of Meters.

A paper by Mr. H. D. King reported the results of tests tending to show that when watt-hour meters do not run at the proper speed the regulation will be incorrect, and if the speed is low, the central station will lose by reason of the energy not registered. He claimed that induction type meters are more accurate and are more easily tested and calibrated than commutator type meters.

Mr. P. D. Wagoner presented a paper containing a large amount of data relating to various illuminants that may be used for street lighting and showing the superiority of the low voltage tungsten lamps for this purpose. He stated that tungsten lamps have a life of 1,500 hours when operated at a consumption of 1.25 watts per candle, the illumination remaining fairly constant throughout the life, while the illumination from a carbon filament lamp decreases by from 25 to 50 per cent. The tungsten lamp can be operated satisfactorily at a frequency as low as 25 cycles, the flicker being more difficult to detect than that of the carbon filament lamp.

For series street circuits the lamps are fed with energy from constant current transformers at 4, 5.5, 6.6 or 7.5 am. The lamps deliver 32, 40 or 60 candle power, consuming 40, 50 or 75 watts.

The committee on the grounding of secondaries, of which Mr. W. H. Blood, jr., was chairman, submitted a report discussing a rule which had been presented to the Underwriters for their consideration. According to this rule, transformer secondaries of distributing systems must be permanently grounded when the difference of potential between the ground and any part of the circuit would be less than 150 volts, but must not be ground when the difference of potential between the ground and any part of the circuit would exceed 150 volts. The committee asked for the unanimous indorsement of a resolution showing desirability of having a rule of this nature inserted in the "National Electrical Code."

Economy in Small Central Stations.

The subject of the design and operation of the small central station in a district having a population not exceeding 20,000 was discussed in a paper by Messrs. J. T. Whittlesey and Paul Spencer. The authors claimed that no piece of apparatus or any appliance should be installed that can not justify itself, not only on the basis of the economy promised by the manufacturer of the appliance, but also on the most conservative basis; full consideration being given to its first cost, its depreciation, the additional labor that its use may entail, and the question of extensive repairs, which can be made in a small plant only with difficulty. They give estimates tending to show that in a properly designed station having a load of 600 kw. and an annual output of 1,320,000 kw. hours, the total operating cost should not exceed 1.4 cents per kw. hour with coal at $3 per ton. When the station equipment is increased to provide for twice the output, the operating cost should not exceed 1.17 cents per kw. hour.

New Frequency Changers for Shawinigan Water & Power Company

Some years ago Montreal attained the distinction of using a larger amount of electrically transmitted water power for general lighting and power purposes than any other city in the world. This amount has been steadily increasing, and one of the means recently taken to supply this increased demand is the installation in the Montreal terminal station of the Shawinigan Water & Power Company of two 1,500 k.v.a. frequency changers for changing to 60 cycles the 30 cycle current received from Shawinigan Falls over the ninety mile transmission line. The current is transmitted by this line at 50,000 volts, and is stepped down in the Montreal terminal station to 2,300 volts.

A large part of this power is converted to 60 cycles by means of five 1,000 kw. and one 4,000 kw. synchronous frequency changers, which have been in operation for some years.

During the past winter there have been put into operation two additional sets, furnished by the Crocker-Wheeler Company of Ampere, N.J., each consisting of one 30 cycle 3 phase 2,300 volt revolving field synchronous motor, driving one 60 cycle 3 phase 2,300 volt generator at 600 r.p.m. The motor and generator are each rated at 1,500 k.v.a. at 80 per cent. power factor, which is equivalent to a capacity of 1,500 kw. under the standard rating condition of 100 per cent. power factor. Each set has two bearings. The rotors of generator and motor being mounted upon a common shaft, thus making exceedingly simply and compact units, the approximate dimensions of base of each set being 13 feet long by 9 feet wide.

No starting motors are required, as the synchronous motors are self-starting from low voltage taps on the step-down transformers. An electrically operated oil switch is used for connecting the motor to the low voltage taps. When the motor has attained nearly full speed, this switch is opened, and the main oil switch, also electrically operated, is then closed, throwing the motor upon the 2,300 volt bus bars. The motor field switch is then closed, followed by the closing of generator field switch. Generator voltage is adjusted to 60 cycle bus bar voltage and generator main oil switch is then closed.

Shawinigan Water & Power Co.—Two 1,500 K.V.A. Crocker-Wheeler Frequency Changers.

As the twelve field poles on generator are an exact multiple of the six poles on motor, no synchronizing is required such as would be necessary if the frequency were changed from 25 to 60 cycles, thus making the operation of starting the sets a very simple and rapid one.

From the closing of the first oil switch for starting the motor until the load is thrown on the generator, the time required does not exceed 1½ minutes. The use of a self-starting synchronous motor also simplifies the switchboard layout, as no synchronizing connections are required.

An interesting point regarding the operation of these sets is the means taken to ensure a proper division of load between the sets, and between these sets and the

older sets, as all the frequency changers in the station operate in parallel on both the motor and generator ends. The proportion of load carried by the different sets depends entirely upon the relative angular position of rotors and stators of motors and generators of the different sets with regard to one another. For example, consider two exactly similar sets: first of all the armature windings of the 30 cycle and 60 cycle ends must be set in the same angular relation one to the other in both sets. The angular relation between the rotors of 30 and 60 cycle ends must also be the same for both sets. If the angular relation between the 30 and 60 cycle rotors of one set is not the same as its relation on another set with which it is to run in parallel this angular relation of the rotors has to be made the same, or the angular relation of the stators must be changed sufficiently to offset the difference in the setting of the rotors. Otherwise, the sets if operated in parallel will not share the load equally, and no amount of adjusting of field current of generator or motor of either set, either before or after the machines are thrown in parallel will alter the proportion between the loads carried. To explain the conditions a little more fully, the following extract from a paper by the writer read before the 1905 convention of the Canadian Electrical Association is given, some slight changes being made:

"The division of load between A.C. generators driven by synchronous motors introduces some interesting points. The problem is somewhat different from all other cases of parallel operation because the speed regulation of the prime movers, that is, the synchronous motors, is zero.

"The proper division of load has, therefore, to be secured in a somewhat different way than in the case of the other prime movers, where a certain drop in speed is required in order to make a generator take its share of the load. The relative position of the field poles upon the low frequency and high frequency ends of two or more frequency changers, which are to be paralleled is very important. If the rotors are not mounted upon the shaft so that the angular position of the low frequency rotor is in exactly the same relation to high frequency rotor, upon all the machines, it will be absolutely impossible to make the machines divide the load properly. The conditions are very much the same as if the rotors of a number of generators were all solidly mounted upon one shaft, in which case, if the pole pieces on the different rotors are exactly in line, and the stators are also exactly in line, the generators will divide the load equally, whereas if one rotor is mounted so that its poles are slightly ahead of the poles on the other rotors, then the generator to which the first rotor belongs will take more than its share of the load. Varying the field excitation of the generator ends of the frequency changers will not alter the distribution of load, but will simply cause wattless currents to flow between the machines."

The eight frequency changers in the station now operate in parallel. When the 4,000 kw. set was installed the 1,000 kw. sets were adjusted to operate in parallel with it. The 1,000 kw. sets each consist of two two-bearing self-contained machines, i.e., one synchronous motor and one generator. The machines connected by means of a flanged shaft coupling.

The two halves of this coupling were rotated with reference to one another, the couplings being fastened together with temporary bolts until an adjustment was obtained, which ensured the proper proportion of the load being taken by that particular set. Couplings were then drilled and reamed for suitable permanent bolts.

It was necessary to adopt a somewhat different method for the adjustment of the 1,500 k.v.a sets, as the rotors of generator and motor were mounted on the same shaft, and could not be rotated with reference to one another without altering the position of the keyway on the shaft.

The stators of motor and generator were therefore tilted in opposite directions by means of shims placed under diagonally opposite stator feet.

This rotated the stators of generator and motor with regard to one another, and provided a simple means of adjusting very accurately the load to be taken by these sets. It was found necessary to shim the diagonally opposite stator feet about 5/8 in., and as the two remaining stator feet could not be lowered it was necessary to raise the bearing pedestals by one-half the amount the stator feet were raised, in order to keep the air gap correct.

The rated capacity of the apparatus at present in operation in the Montreal terminal station is as follows:

14,000 kw. in 30 cycle, transformers for stepping down from the line voltage to 2,300 volts.

12,000 kw. in 30 to 60 cycle synchronous frequency changers.

Three 900 kw. 30 cycle, 3 phase, transformers, to furnish current for the rotary converters.

Three 800 kw. 30 cycle railway rotary converters.

The load of the station is increasing so fast that further additions are now being made to the transformer and frequency changer equipment.

Mechanical Stoking a Success.

One of the largest orders ever placed for mechanical stoking equipment was received recently by the Westinghouse Machine Company, aggregating 14,400 boiler horse-power. This was for one of the large Brooklyn power stations, operated by the Transit Development Company, New York. The order comprises 24 stokers suited to 600 h.p. boilers of the B. & W. water tube type. This is the second large order placed by this company for Roney stokers, and may be regarded as a result of a year's successful operation of the original 7,200 h.p. installation at the Kent avenue station. As this station was originally equipped with flat grates for hand firing, the merits of mechanical stoking have been demonstrated along the lines of high economy and low operating cost.

In the shingle mill of the new Barnet-McDonald Lumber Company, Limited, at New Westminster, now almost completed, the engine room contains the Frost Manufacturing Company's twin engines, 11 x 18 inch cylinder, developing 300 h.p., also a 12 h.p. engine direct connected to a dynamo manufacturing electricity for lighting purposes. This electrical apparatus was supplied and installed by the Hinton Electrical Company of Vancouver.

The boiler room, which is an iron-covered building, is located 62 feet away from the mill, and contains two boilers, each 72 inch by 18 feet, running under 146 pounds pressure. One of these was supplied by the Goldie-McCulloch Company, of Galt, Ont., and the other by the Vulcan Boiler Works, of New Westminster.

Central Steam Stations at Newcastle-on-Tyne, England

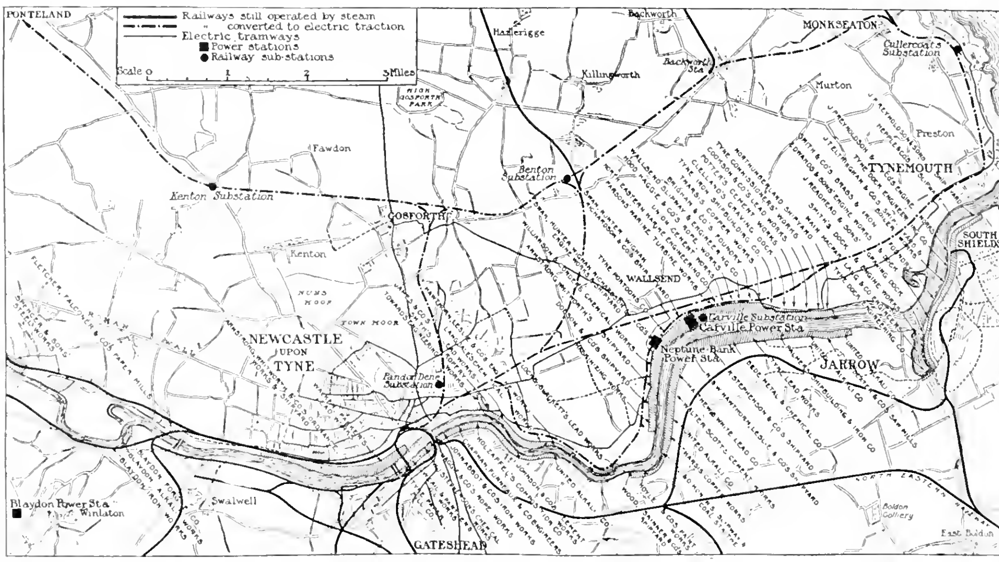
By C. H. Mitchell.

The population of Newcastle is now about 240,000, and it may be said that it is engaged almost entirely in ship-building and its associated industries. These allied works are chiefly for the manufacture of machinery and ordnance, while there are also many chemical works, sheet and plate glass factories, potteries and manufactories of nails, files, spades and other implements.

The history of Newcastle-on-Tyne from an engineering point of view commences with the coal trade, the earliest mention of Newcastle "coals" being in the year 1239. Sea borne coal soon found its way to London, and strangely enough records show that in 1306 the use of what was then called "sea coal" was prohibited in London by proclamation as "a public nuisance corrupting the air with its stink and smoke." The later development of the coal industry led to improvements in mining, and with it the rapid introduction of the earlier forms of steam engines for pumping and hauling. It was here that the two Stephensons did their pioneer engineering work, and later Lord Armstrong worked out his many hydraulic and ordnance inventions; Sir Joseph Wilson-Swan his incandescent lamp (simultaneously with Edison), and most recently Hon. C. A. Parsons in his steam turbine.

That there is now on the Tyne between Newcastle and the sea, nine miles distant, a most remarkable constituency for the electric output of central stations can be readily seen by a glance at the accompanying map. There is a continuous line of manufacturing establishments on each side of the river and an almost unbroken series of docks and slips throughout the whole distance. In the shipbuilding industry alone the output of the sixteen establishments for the four year period ending 1905 was 546 new vessels, with a net registered tonnage of 670,000. For the next four year period this is much increased by the construction of many large ships, notably the "Mauretania," built at Swan & Hunter's yard. There are now thirty graving and twenty-four repairing slips. In 1906 the coal and coke shipped from the Tyne was over seventeen million tons.

Until quite recently all these manufacturing establishments owned and operated their own steam power stations, but within the past ten years there has rapidly developed a central station and distribution business supplying electric current, and many establishments are receiving current from one of the several central stations.



Map of Newcastle-on-Tyne and District.

Of the central steam station systems, that which is attracting the most attention is the Newcastle Electric Supply Company. This organization commenced operations in 1890 with a central station in the centre of the city at Pandon, Dene. By the end of 1900 the plant had a load of only about 1,600 h.p., nearly all in single phase lighting current. Shortly after this, on account of the rapidly increasing demand, the company erected a large station 3½ miles from the city, down the Tyne at Neptune Bank, and with its installation commenced a rapid expansion of business in supply of power current. This company may be said to be the pioneer generating concern in this very large field.

The Neptune Bank Station was designed to supply three phase current at 5,500 volts, 40 cycles; a portion of the installation, however, supplies direct current. The equipment consists of eight B. & W. boilers, two

300 h.p. d. c. units, four 1,200 h.p. three phase alternators, and one 3,000 h.p. Parsons turbo-alternator.

The central station of this system, however, which has attracted such marked attention, is the new station at Carville, which embodies the very latest practice in power station design, special attention having been given to continuity of supply with low capital cost and operation charges. The first commercial current was delivered from this station in 1904. Its location on the Tyne, about four miles below Newcastle, places it very near the centre of the distributing market, as will be seen by a glance at the map. The site has a frontage of 500 feet on the Tyne, enabling an ample supply of condensing water to be obtained, and it also enables coal to be delivered by barges.

Fuel, the first element in this plant, is laid down by railway or barge at the station for the low price of $1.20 per short ton. It is the local Newcastle steam coal. Each boiler house has a separate coal bunker, and the coal is then delivered through automatic weighing machines to electrically driven chain grate stokers. The ashes are removed by an automatic conveyor, discharging directly into the railway cars. The fuel and ashes are thus mechanically handled throughout. On the writer's visit to this plant in July, 1906, with 11,000 kw. being generated, there were only three men about the boiler room. This fact of absence of labor is typical of the whole installation in its design and operation, and is part of the secret of its great success commercially.

The general design presents features of great importance in modern central station practice in the subdivision of the station into a number of independent stations and the adoption of equipment then somewhat ahead of the times (1904), such as the largest capacity steam turbines, water tube boilers of the marine type (B. & W. and Stirling manufacture), and the automatic oil switch electrically operated. The station lay-out is on the complete unit system, that is, each turbo-alternator unit has its own condenser, exciter, set of boilers, pumps, etc., but has with the other units a common boiler house, coal bunkers and chimney. The only other common junction points are the main bus bars and the circulating water system. Complete failure of the station is consequently well-nigh impossible.

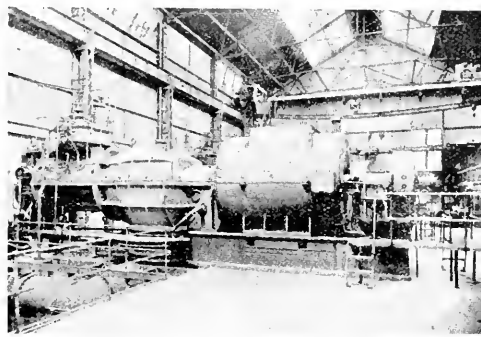
To the Carville station, and especially to Dr. C. H. Merz, the consulting engineer of the company, is the credit of the first trials in England of very large steam turbine units in commercial operation in central station practice. In the earlier 3,000 h.p. units at Neptune Bank station (1902), such excellent results were obtained that there was no hesitancy in installing the two initial 7,000 h.p. units in the Carville station in 1904-5. There are now altogether six of these units in operation, as well as two 3,000 h.p. sets. These are all of the Parsons type, made at the works of that company, a quarter of a mile down the river.

As regards steam consumption, in tests conducted by Dr. Merz one of the units, while generating 4,900 kw. (overloaded) at about 6,000 volts, showed a consumption of 15.9 pounds of steam per kw. hour, with a steam pressure of 194 pounds, superheat at the stop valve 151 degrees and vacuum of 28.6 inches.

The power turbines run at a normal speed of 1,200 r.p.m. and have ordinary mechanical governors which hold to 5 per cent. variation under any load. There are in addition mechanical safety governors which cut off steam when the speed rises to 1,400 r.p.m. The adjustment of governors is primarily effected by hand, but the exact control is by a solenoid at the switchboard, operating a ratchet gear, current for which is supplied from a battery. In the specifications the speed is not to vary more than 3 per cent. between no load and normal and not more than 5 per cent. between no load and maximum. When running at maximum load the variation of speed, when ⅞ of the load is thrown off, must not exceed 6 per cent. While these turbine sets are called 4,000 kw., they are each capable of generating 5,000 kw. for one hour or 5,500 kw. momentarily.

A convenient arrangement is the placing of the condensers and pumps about 10 feet below the level of the turbine floor, but in such a position as to be accessible to the crane.

The alternators are three phase revolving field type, which at normal speed generate at 5,750 volts and 40 cycles. The exciters are two pole machines, mounted on the shaft remote from the turbine, the armatures being connected to the field of the alternators without field rheostats; there are, however, regulating rheostats inserted in the field circuits of the exciters, current for which is supplied by a battery. The exciters have carbon brushes, which have given good satisfaction.



3,500-k.w. Turbo-Alternator in the Carville Station of the Newcastle-on-Tyne Electric Supply Company.

The switching devices at the time of their installation were comparatively new, but now excite much less curiosity. The points striven after in the design of the gear were mainly isolation of circuits, especially in cables, auxiliary apparatus and outgoing feeders; the switch house was absolutely fireproof and extension was especially provided for. This necessitated a very long switchboard, and the multiplication of galleries, there being four and a cable basement. The two top galleries contain bus bars; the ground floor has instruments, transformers, etc., while the main switches, motor operated, are on the second. The switchboard is, rather than a board, a wall built up of concrete slabs into cells or narrow chambers enclosed by iron doors.

For distribution, current is conveyed through about 80 miles of 20,000 volt transmission system to some 38 sub-stations, of which 12 are for traction, about 8 for lighting, and the remainder motor load for industrial purposes. The total sub-station capacity in 1907 was about 48,000 h.p. The amount of power supplied for the various classes of works in 1906 was a (maximum) total of about 5,300 h.p. Of the 30 large power consumers from this plant in the Newcastle district, about 20 use three phase, while the remainder use direct cur-

rent. In one of the largest customer's installations 35 induction motors, from 2 to 75 h.p., and aggregating 990 h.p., are in operations.

The rates at which energy is supplied are as follows: For lighting, 7½ cents per kw. hour; for heating, 3 cents per kw. hour. For power the rates depend upon the usual circumstances, such as amount, hours of use, load factor, etc. The average price per kw. hour obtained by the company in 1906 from all sources was 1.9 cents, while the cost of production was 1.1 cents per kw. hour. Figures for 1907 are not available, but it was estimated that the cost of production would be reduced to 0.7 cents per kw. hour, and that the sales would reach 83 million units (kw. h.). A recent contract now in operation with the Castner Kellner Alkali Company, who were erecting works alongside and taking power direct from the generators, is said to be based on a supply of 24 million units per annum and that it would figure (continuous process 24 hours per day) to the extraordinary low price of $21 per horsepower year.

Commercially and financially this company's installation is a signal success. The first cost of the present plant is said to be at about $72 per kw. complete. It has paid dividends at the rate of 8 per cent. every year since 1897, and it has consequently been able to market new issues of capital at a premium—the amount of such premiums up to 1905 having been over $700,000 —and out of this it has within the later years entirely replaced its original system installed in 1890. The present authorized capital amounts to about eight million dollars.

Montreal's Light Rates Reduced.

The Montreal Light, Heat & Power Company have announced the following revision and reduction in rates for lighting service.

The present rates of 15 cents per kilowatt hour less 5 per cent. on one year contracts and 15 cents per kilowatt hour less 15 per cent. on five year contracts, for all current consumed, for residential and commercial purposes will be reduced as follows:

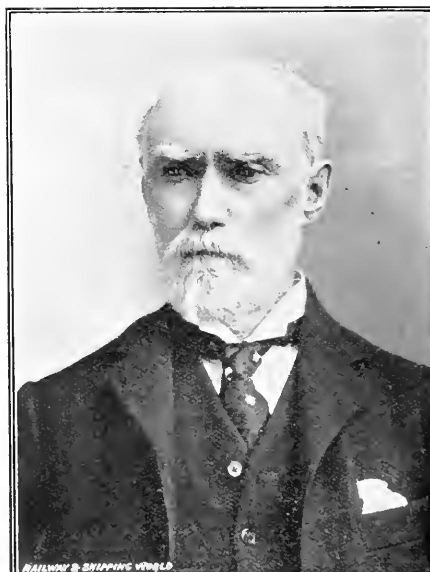
Residential Service.—One year contracts, "primary usage" of first 30 hours, 15 cents per kilowatt hour with a rebate of 10 per cent.; "secondary usage," 15 cents per kilowatt hour with a rebate of 50 per cent. Five year contracts, "primary usage" of first 30 hours, 15 cents per kilowatt hour with a rebate of 20 per cent.; "secondary usage," 15 cents per kilowatt hour with a rebate of 60 per cent.

Commercial Service.—One year contracts, "primary usage," of first 60 hours, 15 cents per kilowatt hour, with a rebate of 10 per cent.; "secondary usage," 15 cents per kilowatt hour with a rebate of 50 per cent. Five year contracts, "primary usage," of first 60 hours, 15 cents per kilowatt hour with a rebate of 20 per cent.; "secondary usage," 15 cents per kilowatt hour with a rebate of 60 per cent.

Gas Lighting Service.—The present contract with the City of Montreal for the supply of gas to citizens, does not expire until 1910. The company have, however, decided to allow an immediate rebate of five cents per thousand cubic feet of lighting gas consumed, effective on June bills. It is the company's intention to further reduce the cost of gas lighting service and eventually supply both lighting and fuel gas through one meter. The company also intends to make further reductions in rates from time to time as conditions admit.

The Father of Canadian Telegraphy.

Eighty years of age and still in the harness, is a boast which few men can make. Mr. H. P. Dwight, President of the Great North Western Telegraph Company, is able to do so and to take satisfaction out of the fact that he is not occupying any sinecure in his old age. Five years ago Mr. Dwight retired from the active management of the company to become its president and it was thought at the time by those who did not know him intimately that this was an easy way of letting him down and enabling him to retire and enjoy a rest for the remainder of his days. But Mr. Dwight did not see it in this light, and a few days ago when a representative of the "Canadian Electrical News" called upon him, he found Mr. Dwight just about as active as ever. In fact the reception he received was a breezy



H. P. Dwight, President of G.N.W. Telegraph Co.

announcement from Mr. Dwight that he was too busy to be able to give anything in the form of an interview. He made things pleasant for his visitor, however, and subsequently placed him in touch with the desired information.

Mr. Dwight went into harness so early in life that it would probably be more than he could stand to-day if he had to lay it aside. He is the kind of man who cannot put up with idleness. No single life could be more intimately connected with the growth of a business than Mr. Dwight's has been, with that of the telegraph in general and of the Great North Western Telegraph Company in particular. He commenced life as a telegrapher in the days when telegraphy was scarcely more than an experiment. He schooled himself in the art of telegraphy as a lad, and in the short space of a year and a half become one of the most expert telegraphers of his day. Since then he has witnessed the march of telegraphy across and up and down the continent and has ever been in the front rank of the advance.

Mr. Dwight was born on December 23rd, 1828, on a

farm near the village of Belleville, Jefferson county, N. Y. He lost his parents when he was a boy and was left with a useless farm and a future. The future turned out to be the more valuable of his inheritances. At the age of nineteen he entered the service of the Montreal Telegraph Company as an operator. The company was then, just organized, and Mr. Dwight was stationed at Belleville, Ont. The story of his application for this position is worth telling. He left his farm soon after it became his own and launched forth into the world to earn a livelihood. The telegraph line had just been completed between New York and Buffalo, with a branch from Syracuse to Oswego. With young Dwight it was a case of "Pike's peak or bust," and he determined to scale the peak. He tramped over the corduroy roads to Syracuse and begged hard for the privilege of learning telegraphy in the Oswego office of the new company. The permission was granted and he plodded away to the town where he was to learn the meaning of the dots and dashes. A year and a half later he was one of the best operators in New York state. But he was young and ambitious and being dissatisfied with his position cast about for better opportunities.

Mr. Dwight's Arrival In Canada.

Hearing that lines were being erected in Canada he wrote to Mr. C. S. Wood asking for a position with the Montreal Company. The answer he received was short and to the point. It was "as soon as you are qualified to do the work come on." He came on at once and has been "coming on" ever since.

Operators were rare birds in those days and Mr. Wood met the young man when he landed at Kingston. On September 27th, 1847, Mr. Dwight, then the operator, now the president, opened his key and sent a message to Montreal. There were only twelve offices on the line at that time and when Mr. Wood heard the young man sending messages with the speed of an expert he returned to Montreal leaving Dwight in charge of the Belleville office. Less than three months later Mr. Dwight received a message saying "come to Montreal." There were no railways in Canada then and Mr. Dwight made the journey to Montreal in a stage. There he remained until 1850 when the lines were extended to Toronto and he was sent to the new office. Again he travelled by stage over the country that one covers to-day in a night while sleeping in a pullman. The roads were bad, the hotels were worse and the vehicles of the day were worst. During the first year of his work in Toronto Mr. Dwight received and sent every message that came to or went from the city. He had one little messenger boy, a Scotch lad with an accent and a plaidie, but the boy was ambitious and hardworking and hustled about with the messages probably faster than any of the boys of today, though he had no bicycle or street car to assist him. The lad is still in the employ of the company although he has outgrown his youth. He is known as Robert F. Easson, superintendent of the press department of the company's lines.

Soon after his arrival in Toronto, Mr. Dwight became general Western superintendent for the company. Three years after the success of Morse had been demonstrated, the first telegraph line in Canada had been established. Buffalo had effected communication with Niagara Falls and it was desired to extend the wires on to Toronto. To that end the Toronto, Hamilton, Niagara Falls and St. Catharines Electro-Magnetic Telegraph Company were incorporated with a capital of $16,000. They built what was described as "an honest and well appointed line." The Montreal Telegraph Company also entered the field in 1897 with a capital of $60,000 to construct a line from Toronto to Quebec city. This company subsequently acquired the line to the Falls. Meanwhile, in the east, the British North American Electrical Association was endeavoring to connect Quebec with the Lower Provinces. For some years the line ended at Riviere du Loup. Its first month's receipts were only $56 and the subsequent months were not financially successful. Consequently this company and another concern—The American Telegraph Company—were eventually turned over to the Montreal company.

At the time therefore, when Mr. Dwight was made general Western superintendent of the Montreal Company, the system was growing extensively. So also was the man who was to control it. Mr. Dwight's instructions on taking office as Western superintendent were to extend the lines throughout Ontario as he thought advisable. Sir Hugh Allan was at that time president of the company. An important rival entered the field in 1868, when the Dominion Telegraph Company was organized. This company soon covered all important points between Detroit, Buffalo and Quebec. It offered vigorous competition. There was cutting of rates, and hustling for business. Finally, in 1881, the Great North Western Telegraph Company absorbed both the Dominion and the Montreal companies under the general management of Mr. Dwight, who became president in 1902. In 1886 a powerful competitor arose in the C. P. R. company, which established itself in the principal cities of the Dominion and was not destined to be absorbed.

One of Mr. Dwight's most notable services to the company and to the Dominion of Canada, occurred at the time of the Fenian raid. He knew every acre of land on the frontier of Ontario, for he had travelled it scores of times, and when the trouble came he sat in his office at Toronto in close touch with the Dominion Government and received from his operators from the front, full and accurate reports of the trouble, and of the movements of the invaders. These he quickly sent to Ottawa and it was due to Mr. Dwight, more perhaps than to any one man, that prompt action was taken. During the Northwest rebellion in 1885 he also rendered similar service to the Government, enlightening them through the medium of his operators, whom he had scattered throughout the most remote districts of the country. His services in this connection were publicly acknowledged by the Minister of Militia in Parliament.

A Few Reminiscences.

When Mr. Dwight is in a reminiscent mood he can recall many interesting events of the early days in Canada. "I have very lively recollections," he said, "of Hamilton in the old stage coaching days. It was a lively town in those days when the stages drove up before the old city hotel at seven o'clock in the morning, and we started off for London; where we arrived generally about nine p.m. and thought we had made a pretty good day's journey. When the Great Western Railway was being built I used to think what a grand thing it would be, to go on board a train at Hamilton and reach London in two or three hours. There was not a mile of railway in the province of Ontario when I came to Toronto in 1850."

Mr. Dwight has always taken an active interest in civic government and has identified himself with every

progressive movement in that direction. He was one of the pioneer promoters of the electric lighting in Toronto. The telephone also, in its early and experimental days, had the benefit of his wide electrical knowledge. The first telephone wire ever used in Toronto was strung between his private residence and the testing station. It is not so many years ago, even now, when a man bearing in his pocket a small parcel, and in his mind a secret, called on Mr. Dwight. He was the inventor of an improved incandescent light. It had never been seen in Toronto before. The inventor had shown it to two or three prominent men who looked at it with suspicion. Mr. Dwight saw it, and with the same keen eye that saw a future for wires in Ontario's remotest places, he saw the future for the incandescent light, and fitting up a battery he fathered the inventor's idea. The first light from an incandescent lamp in Toronto shone from Mr. Dwight's own office.

Another of Mr. Dwight's reminiscences is of the early days in Toronto. Wagons were often mired in the mud on Jarvis street opposite what is now an exclusive residential part. Rosedale was a mystery, save to the man who wanted to tramp through forest, and it was here that Mr. Dwight's executive ability became noticeable. He was given a free hand and invited to make suggestions and do things. With business eye and intuition, he saw Ontario's future, and gangs of men were sent broadcast throughout the province to string the company's wires. One day he received the following sarcastic wire from Montreal, "Aren't there any more sawmills you can reach with wires?" Other extensions were made, however, and Mr. Dwight's policy was sustained.

The popularity of the telegraph has been largely due to the cheapness of its rates. During the era of expansion Mr. Dwight discovered that cheapness was a prime factor in development. The principle of multiplied small profits, which in our times has produced penny postage, a three cent mileage on railroads, five cent trolley fares, the cent newspaper, and five cent sugar led in Mr. Dwight's early days, and at his suggestion, to the flat rate of twenty five cents on all messages, regardless of distance. The cut rate both simplified and increased business. Under Mr. Dwight's management the G. N. W. has grown from a small company with a few offices to one operating a great network of lines. Since 1847 there have been established 30,216 miles of telegraphic communication in Canada, with a wire mileage of 86,207. There are now 2,696 offices transmitting about 6,000,000 messages annually.

One of the secrets of Mr. Dwight's wonderful health is his love for the open air. In the fall and summer he is a regular follower of the deer runs and trout streams. With his gun and his fishing rod he penetrates to the country where the wire never flashes, and where he cannot be molested with telegrams. His mind is singularly attracted by the great spaces and the solitudes as well as by the cities and the busy haunts of men. All the way from the stump farm to the presidency of the G. N. W. his life has been one of strenuous optimism. In his office he has his finger on the pulse of business, yet he can turn from that to an act of philanthropy or charity on a moment's notice. Men of great mark have risen from under his hands. Dilatory men have learned from him the golden fruits of diligence. But he is still the simple souled H. P. Dwight, wondering as much at the incredable promise of electricity, as he did on the day when he first heard the telegraph wire hum over the stump fields of Oswego.

This is briefly a story of a man and a system. What that system has become in the development of Canadian civilization is the story of hundreds of newspapers, gridirons of railways, lines of steamships, sessions of parliament, grain and stock markets, money markets and weather bureaus.

Mr. Dwight's business key note is the word which sums up telegraphy—despatch. Crossing a street, he takes a short cut. Arrived in his office he sits down with his hat and overcoat on to finger over a handful of despatches. Eighty years of looking have left his blue eyes scornful of spectacles. He carries his youth into his old age and remembers every detail, because he has a working mind. A telegraph instrument is not more a symbol of restless energy. With great rapidity he turns from a despatch to a handshake and two seconds after his friend has gone, he is buried again in his work.

British Machinery In Canada.

Electrical machinery manufactured in Great Britain has already obtained a strong hold upon the Canadian market and continues to increase in popularity. Canadian representatives of English firms, who are in a position to supply goods on short notice are finding an ever enlarging demand for their articles. We understand that the Gas and Electric Power Company whose offices are situated in the Stair Building, Toronto, are in a position to supply alternating current machinery of almost any size. The company whom they represent, the Electric Construction Company of Wolverhampton, England, recently installed three units of 3,000 k. w. each. A cut of the armature ring is shown in their advertisement on page 12. This machinery appears to be of very high grade manufacture. There are many special features about its design which are worth noting. The rotating field is built up entirely of laminations, except of course, the spokes of the wheel which are of castings. These machines are coupled direct to the engine on each side by steam units of 2,000 h.p. each.

They also are handling a very high grade alternating current, polyphase motor for 60 or 25 cycle circuits, the winding being of a patent design. By this means considerable money is saved in the price of the machines, yet at the same high efficiency is obtained, together with the best of workmanship. The company are also manufacturers of high grade interpolar direct current machines. These are fitted with commutating poles, which overcome the difficulty of sparking at the commutator. Sparking is practically done away with entirely. The machine is capable of handling any load up to a certain temperature. In other words, it is not rated by the sparking at the commutator, but at a safe working temperature of the winding. These machines are made for all standard voltages and the company is able to make quick delivery.

The Gas and Electric Power Company are also the sole agents for Messrs. Ferranti, Ltd., of Hollinwood, England, who are well known for their high grade electrical instruments and switch boards of both high and low tension. They are now doing quite an extensive business in Canada in electrical integrating wattmeters. These meters have to their credit an extremely simple design. The instrument is free from complications and possesses very few parts that are likely to cause any trouble. It has an extremely low starting current of only one-tenth of an ampere, and the makers

protect it by responsible guarantees. These meters are made both alternating current and direct current, and the company also manufacture polyphase meters of similar design.

The Gas and Electric Power Company have recently obtained an order for a year's supply for these instruments from one of the largest municipalities in Canada, while other corporations and companies are taking a lively interest in them. The Messrs. Ferranti, hold sixty per cent. of the business in Great Britain and supply all European countries with these meters. They have secured orders for 10,000 instruments for Milan, Italy, where the competition was of the severest nature both for prices and design. The manufacturers have an output of some 50,000 meters a year, and are well able to take care of any contracts they are able to secure in Canada. Delivery can be made from stock in Canada but for large orders, has to be made from Great Britain. This can be done, however, in from fourteen days to three weeks.

The Gas and Electric Power Company's switch boards are exceptionally good, both as regards value and design. Their great stability is a point in their favor yet at the same time, the utmost care has been taken to obtain the best electrical results. Their prices make them very interesting to prospective buyers. The company are manufacturing switch boards in Toronto and are in a position to supply boards suitable for generator plants, either alternating or direct current or for panel board work. They are also agents for the supply of paper insulated lead covered cables.

In regard to the Ferranti meter it should be noted that the dial is of a cyclo meter type of apparently extreme simplicity, as shown in cut of their advertisement on page 12. The thousands of meters that have been sent out have proved that this design is far preferable to that with the ordinary set of train wheels. The dial and the general design of these meters are shown in the cuts. The Gas and Electric Power Company are also handling an enclosed flame arc lamp, of seventy hours' duration which they claim, is the only successful enclosed flame arc lamp which has yet been placed upon the market.

Despatches from Washington recently made it appear that the passing of a treaty settling the question of the use of Niagara waters as between the United States and Canada was being held up by the refusal of the Dominion to come to terms. A despatch from Ottawa, on the other hand, says: Opposition to the conclusion of the treaty comes not from Canada, but from the United States Senate. The Canadian Government has been all along willing to abide by the arrangement reached some years ago by the International Commission and incorporated in the Burton Act of the United States. That arrangement regulating the amount of water to be taken from Niagara Falls on each side of the boundary expires in June of next year, unless the Act is then extended. It was the expectation of the Government that the present treaty negotiations would result in an agreement to perpetuate the present arrangement, but the United Senate now seems to be blocking the proposal.

A recent decision given by the New Jersey Bench, to the effect that individual States have jurisdiction over rivers contiguous thereto, further complicates the situation. It had been supposed that the Federal Government of the Republic had to deal with all international waters by treaty, but this decision of the court now throws some doubt on the matter.

A Leading Lamp Manufactory.

An important Canadian industry is the Ontario Lantern & Lamp Company, of Hamilton. This firm have been in the light producing business for eighteen years and have met with deserved success. Their business is confined almost exclusively to producing goods for lighting purposes, from the common kerosene lamp burner to the highest standard of incandescent lamps. In connection with this article is published a portrait of Mr. W. H. Ginder, the president and manager of the company. Mr. Ginder came to the company four years ago in the capacity of superintendent. He is a practical man and has "made good" to such an extent that he is now the head of the concern.

W. H. Ginder, President and Manager of the Ontario Lantern and Lamp Company.

The company's trade has grown very rapidly during the past few years and they have been obliged to greatly increase their premises. The contract was recently let for a new building with a floor space of 7,000 square feet, to be erected at a cost of $5,000. The new premises will be equipped with the most modern lamp machinery for the exclusive manufacture of Brilliant and Shelby incandescent lamps. The company have published a very handsome catalogue, which they will be pleased to send to anyone in connection with the trade.

X Cells Dry Batteries are Popular.

The X cell dry batteries which have been placed on the Canadian market by Electrical Specialties, Limited, of 12-16 Shuter street, Toronto, have been very favorably received. We understand from the general manager, Mr. Alfred Landau, that he is daily in receipt of letters from customers expressing the greatest satisfaction with the quality of the cells. Their factory is now turning out a larger type, known as No. 7, whose recuperative power is very high.

A Modern Telephone Exchange

The British Columbia Telephone Company's Equipment at Vancouver.

If but one thing were needed to convince a visitor to Vancouver, of the wonderful growth of Canada's Western Gateway, a visit to the new exchange and head office building of the British Columbia Telephone Company, Limited, on Seymour street, Vancouver, would accomplish that result.

The new building is of solid brick, cement and steel structure, rising three stories above the basement, and covering an area 45 by 120 feet. It is of fireproof construction throughout, with cement floors and stairway, and steel fire escapes. Messrs. Dalton & Eveleigh, of Vancouver, were the architects, and Baynes & Horie, the contractors in charge.

B. C. Telephone Company.—New Head Office and Exchange.

Entering off Seymour street, the visitor is in a beautifully appointed public corridor about 38 feet long by 16 feet in width. On the left are the local offices, including the local manager's office. At the rear end of this hall, a number of public telephone booths are located. Here the public hall proper ends, but passing through a doorway at the end, one enters a long passage about six feet wide, running clear through to the janitor's quarters at the rear of the building. On the left of this passage, and immediately following the local offices, is the wide concrete stairway; a side entrance, for employees use only, being situated at this point. Beyond the stairway is the general foreman's department, consisting of two rooms, one of which is the installer's room.

Beyond this again is the janitor's residence, extending across the rear of the building, and consisting of three large rooms, bedroom, kitchen and living room, respectively.

Coming back to the front, and to the right of the entrance, is the general manager's office, the windows of which overlook the street. This is succeeded in turn by the stenographer's office, the special agent's office, and the large general office, each in the order named. A feature of the general office is the large vault, which has been specially fitted up with metallic filling equipment. At the rear end of the general office is the secretary's office. This opens into a large Board room, about 13 by 20 feet. All the offices are well lighted, the company owning the land for thirty feet on the sides of the building.

On ascending the stairs to the first floor above the ground floor, one finds the upper landing is located almost exactly in the centre of the flat. The front half, an area about 50 feet long and the full width of the building, is given up entirely to the power plant, fuse panels and the distributing racks, with the battery room, about 11 by 25 feet, occupying one corner. This battery room contains one set of 24 volt, 380 ampere hour batteries, and another smaller set of 24 volt, 100 ampere hour batteries. This last is a booster set.

B. C. Telephone Company.—Switchboard—Long Distance Board on the Left.

Outside, in the larger room, is the power switchboard, equipped with volt meters, circuit breakers, rheostat and auto starters. The other equipment of this room includes a 25 horse power motor, Westinghouse make, direct connected to a 30 ampere generator made by the Western Electric Company, also a 2 h.p. Westinghouse motor, direct connected to a 25 ampere Western Electric generator. The latter machine is for charging the booster battery. In addition to this power plant, there is an auxiliary power plant in the basement, consisting of a 25 h.p. gas engine, belted to a 30 ampere generator.

For ringing purposes, the company has a one-quarter horse power Emerson motor, belted to a 75 volt generator; also a motor generator driven by the 24 volt storage battery. These two ringing machines are run

alternately. They are equipped for two-party and four-party line ringing; also they are used for operating special signals on the switch-boards. Besides the above, the power room also contains the wire chief's desk.

At the rear of the power room, and opening from it, is the switch-board and construction department, where all switch-board and construction repairs are attended to.

The rear half of the first floor is given up wholly to rooms intended for the comfort and convenience of the young ladies who operate the switches. This consists of a cloak room, drying room, toilet, lavatory and bath rooms, sitting room, lunch room, and fully equipped kitchen. The lunch and sitting rooms are handsomely carpeted and furnished in mission oak, the latter containing an abundance of good reading matter. Here the girls may, when off duty, find amusement and recreation, and entertain their lady friends. The drying room is an especially thoughtful idea of the management, being provided to meet the need of a place

B. C. Telephone Company. Rear of Switchboard.

to dry the outer garments on a wet day. The large cloak room is replete in well-ventilated steel lockers, each with private lock. There is a matron in charge of these quarters.

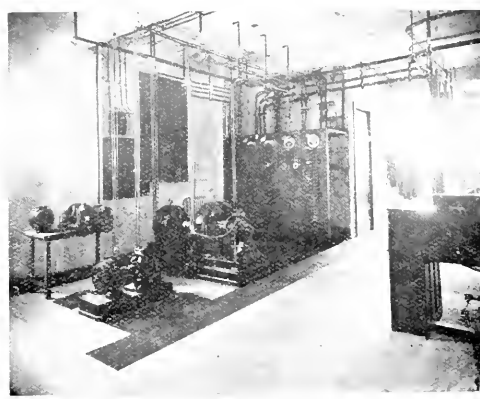
Another especial feature of this department is that lunches are gratuitously supplied by the company to all the lady employees. These are provided at all the regular meal times to those girls who desire to take advantage of it. The privilege is also extended to the night shift. The company are especially careful of the quality of the food provided at these repasts, as is evidenced by the fact that the milk supplied is shipped in sealed vessels, direct from the dairy.

The top flat is given up entirely to the switch-board purposes. This is one large room, the full size of the building, roomy, well lighted and ventilated. Along one side, and for about two-thirds the entire length of the room, runs the local switch-board containing 4,200 lines at present, but provision has been made for extension up to 10,000 lines. The board is, of course, on the central energy system. A special feature of the board is a series of green lights, located every two sections apart. These are used only at night time, when only a few girls are working, and might be described as auxiliary pilots. When a subscriber calls up at night, not only does the call light the little lamp at that number, but also lights the larger green lamp at that section of the board, thereby enabling the operator to note more readily when and where a call is being made.

At the front end of the room, and at right angles to the local switchboard, is the long distance switchboard. There are fifteen long distance lines working direct from this office, giving direct connection to all parts of the coast mainland, and by submarine cable to Victoria City and Vancouver Island generally.

The switch room contains also the inquiry and trouble desks, the chief operator's desk, and that of the inspector in charge. On the opposite side of the room from the switchboard is a wide doorway opening onto the fire escape.

In the basement are located the steam heating plant, the coal room, store rooms, the instrument repairing room, and the linemen and cable splicer's quarters.



B. C. Telephone Company.—The Ringing Machine.

Here also is another large vault, for storing old books and papers. At one corner of the basement all wires and cables leave the building, in underground conduits.

The entire mechanical equipment of the new building was supplied and installed by the Northern Electric Company of Montreal, and since its installation, about a year ago, has proven thoroughly satisfactory.

The British Columbia Telephone Company is one of the oldest and strongest concerns on the coast, and its growth has been such that it now covers not only Vancouver, but also the cities of new Westminster and Victoria, including all intermediate and surrounding points on the coast mainland, and on Vancouver Island; also, by means of its connection with the American coast telephone companies, subscribers can get direct telephonic connection with the city of Seattle and other points on the coast.

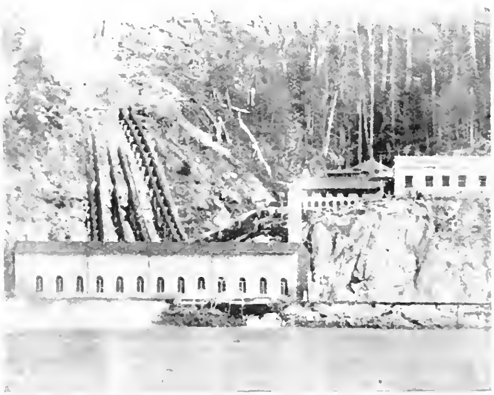
In addition to the coast service, the British Columbia Telephone Company operates a complete system of local and long distance telephones in the Southwestern Kootenays, giving service to the cities of Nelson, Rossland, Trail, Greenwood, etc., and all other adjacent points.

Modern Electrical Development on the Canadian Pacific Coast

The British Columbia Electric Railway Company.

The hydro-electric development of the British Columbia Electric Railway Company, Limited, of Vancouver, contains several features which are of interest, among them being a dam at the outlet of Lake Coquitlam to raise its level and create storage; a tunnel connecting Lake Coquitlam with Lake Buntzen; a concrete dam across the outlet of Lake Buntzen, which increases its storage capacity; pipe lines connecting the concrete dam with the power house situated at sea level, and transmission lines extending from this point to Vancouver, New Westminster, North Vancouver, Burnaby, Lulu Island, and Ladner.

Lake Coquitlam has an area of 2,300 acres, while the area of the drainage basin at Coquitlam is 103 square miles. The average precipitation for several years back has been 146 inches. The tunnel connecting Lake Coquitlam with Lake Buntzen is through solid rock and passes under a mountain 4,000 feet in height. Its



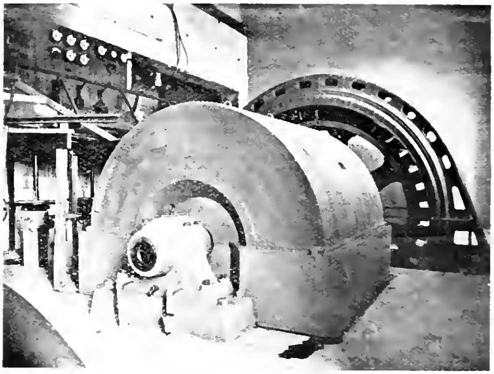
B. C. Electric Railway Company. Power House on Burrard Inlet.

length is 12,774 feet, and a cross section measures 9 feet by 9 feet. In obtaining the alignment, the engineers made a triangular survey over the mountain, but in determining the levels, the survey was carried around, not over the mountain, making it necessary to run about 20 miles of levels, in order to connect both ends.

The building of the tunnel was done from both ends. The closing error in alignment was only 7/8 of an inch, and the error in level only 1 3/4 inches. The area of Lake Buntzen, into which the tunnel empties, is 460 acres, with a drainage basin covering seven square miles. Lake Buntzen dam has a maximum height of 54 feet and a width at the base of 40 feet, its length on the crest being 361 feet. It is penetrated by ten 54 inch and two 24 inch pipes, all fitted with gates and screens on the upstream face. Ten thousand cubic yards of concrete were used in the construction of this dam.

The pipe lines extend from the dam to the power house, a distance of 1,800 feet. At present seven pipe lines are in use. The upper 800 feet of six of the lines is constructed of wood stave pipe, four of them being 54 inches in diameter and two 60 inches in diameter. The lower 1,000 feet is of rivetted steel construction. The exciter pipe line, 24 inches in diameter, is of steel throughout.

The grading of the trench and the provision necessary for the support of the pipes, was a very difficult problem. Near the lower extremity of the line a vertical rock bluff, 70 feet in height, was encountered, which made it necessary to carry the pipes on a temporary trestle. After the completion of the pipes these



B. C. Electric Railway Company.—The Latest Unit Added at Power House.

trestles were replaced by concrete piers. The pipe lines throughout were built to curves and tangents, both vertically and horizontally, the result being that they have a very pleasing appearance, while at the same time high efficiency is secured.

B. C. Electric Railway Company. One of the Shunters for Hauling Freight Cars.

The power house is situated on the North Arm of Burrard Inlet, at sea level, and is built of stone on concrete foundation. The capacity at the present time is 22,000 h.p., made up of four units of 3,000 h.p. and one unit of 10,000 h.p. Plans and specifications are now being prepared for an additional unit of 10,000 h.p.,

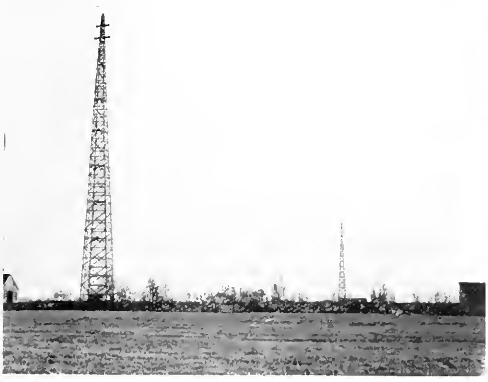
which will be installed about the end of the year. The ultimate development is 42,000 h.p.

Water is supplied under a static head of 400 feet. Pelton water wheels are used throughout, with Lombard governors. The generators are three phase, 60 cycles, of the Canadian Westinghouse and Canadian General Electric Company type. All transformers are of the air-cooled type, and are placed in separate con-

B. C. Electric Railway Company. Fraser River Crossing at Woodward's Landing.

crete buildings, which also contain the high potential switches and appliances.

The voltage on the transmission line is 20,000 and at this pressure is transmitted to the substations at Vancouver, North Vancouver, Burnaby, New Westminster, Lulu Island and Ladner. The transmission line has a length of about 16 miles to Vancouver, and consists of a double line of poles. It is, the most of the distance,



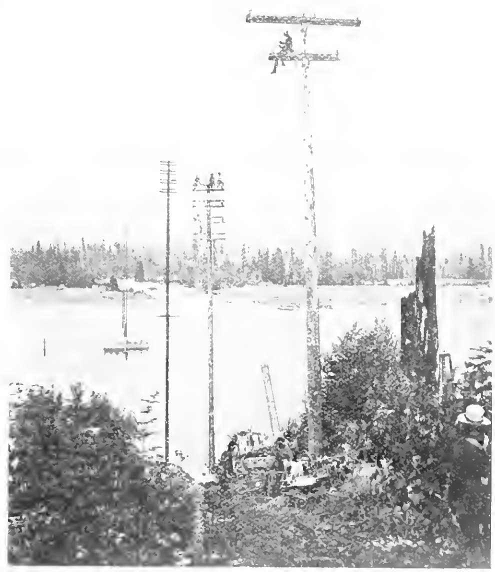
B. C. Electric Railway Company. Towers 320 Feet High Crossing Fraser River.

on the Company's own right of way, which is 100 feet wide.

A notable feature is the crossing of Burrard Inlet near Barnet. The span is 2,750 feet, and the current is carried by steel cables suspended 150 feet above sea level at the lowest point. On the southerly end of the span are two steel towers, each 150 feet in height and set on the top of a knoll, bringing the top of the tower 300 feet above sea level.

From Barnet the two pole lines follow the same direction for about three miles, after which one goes directly west to Vancouver, while the other goes south to the Burnaby sub-station, and from there along the right of way of the Westminster Interurban line to Vancouver and also to New Westminster City.

In crossing Burrard Inlet at the Second Narrows, to carry power to North Vancouver, two masts 230 feet in height were erected to carry the steel cables. The illustrations show this crossing. These masts are made of two poles 150 feet and 100 feet spliced together. To see these splendid poles—obtainable only in British Columbia—one would actually think they had been turned in a lathe. The span at this crossing is 1,000 feet and the telephone or lower wires are 160 feet above high tide.



B. C. Electric Railway Company. Transmission Line Crossing Bnrrard Inlet.

From the Vancouver sub-station, the transmission line runs along the company's right of way on the Lulu Island Railway Branch, across Lulu Island to Steveston and Ladner. In crossing the Fraser river from Woodward's Landing to Ladner, extraordinary construction had to be resorted to. Owing to the shifting nature of the bed of the river, cables were out of the question, and overhead construction was decided upon, the towers used being 320 feet high. These, it is said, are the highest towers in the world for transmission line purposes. They are built of wood, and have stood the hurricanes which are common at this part of the river. The patrolman goes to the top of these towers once a week. The scenery from the top is magnificent. The conductors here, as at Barnet and Second Narrows crossing, are of plow steel cable. Tower No. 1, 320 feet in height, is erected at Woodward's wharf. Tower

No. 2, also 320 feet in height, is erected on the north side of Kirkland's Island. Tower No. 3, 280 feet in height, is erected on the south side of Kirkland's Island. Tower No. 4, 260 feet in height, is erected 2,000 feet further south from No. 3. The spans between the towers run from 1,950 to 2,000 feet. The lower wires are 165 feet above high tide. From tower No. 4 to the shore, the poles are set on the mud flats, 5-pile dolphins being used to support them. These flats are covered with water at high tide. The accompanying illustrations give a fairly good idea of the construction.

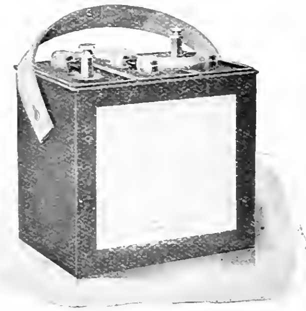
Comparison of Fire Causes.

Fires and insurance losses on brick and frame protected school buildings in the United States during two years have been tabulated. The principal causes were lightning, hot air furnaces, defective flues, sparks on roofs, electric lighting and spontaneous combustion, in the order named. The line of business having proved a losing one for all concerned, the Continental Fire Insurance Company says it is quite possible to reduce the number of fires by revising the electric wiring, fitting lightning rods, looking after heaters, and last, by having incombustible roofs.

Crofton Storage Battery Company Enlarge Their Generator Equipment.

The Crofton Storage Battery Company, established in Toronto in 1898, are just finishing the tenth year of doing business in Canada. The amount of business they have done during this time has been very gratifying, and the large number of their "Vulcan" storage batteries in use in Canada testify to the very high merit of their product.

They have lately installed a larger generator equipment, to take care of their increasing orders. Their plant is thoroughly modern and efficient in every way. The generating equipment consists of a 20 horse-power



The Vulcan Sparking Battery.

crude oil engine connected to a direct current multipolar generator of 100 ampere capacity. This generator supplies the necessary current for operating separate motors on their lathes, grinders, perforating machines, forge, etc., as well as for the formation of charging current used in the construction of their batteries.

Their batteries are guaranteed for a period of two years, and are giving every satisfaction.

Sparks.

The water commissioners of London, Ont., will ask the city council to submit to the ratepayers a by-law to carry out the Mowry water scheme, estimated to cost $560,000. This project provides for taking in the whole Mowry north branch filtration and Wilworth springs, which will provide 500,000 gallons of spring water daily.

An independent telephone company is being organized at Palermo, Ont., by Dr. Buck. Plans call for lines to connect Palermo, Omagh, Bronte, Postville and Drumquin. It is expected that financial arrangements will be completed by the beginning of May. Construction will be started as soon as the necessary supplies can be obtained.

Thirty-two persons were killed and 320 injured by electric railways in the Province of Ontario during the year 1907, according to the report of the Ontario Railway and Muncipal Board. Of those who last their lives, seven were passengers, seven were employes, one was a trespasser, and seventeen were pedestrians who were run into by the cars.

The Wentworth County Council has passed by-laws giving franchises to the Barton and Binbrook and West Flamboro' private telephone companies. The Barton and Binbrook Company has about 40 subscribers, and will build about 29 miles of line through those townships, and the West Flamboro' Company will build about 4 1-2 miles of line at present.

The ratepayers of Victoria, B.C., have approved by-laws for the following purposes: to raise $70,000 for school buildings and site in the north end; $70,000 for high pressure salt water system for fire protection; $20,000 for additional firehalls and apparatus, and $50,000 for extensions to sewerage. No delay will be made in commencing the various works.

Sparks.

Mr. Henry D. Bayne, manager of the Canadian Westinghouse Company, Limited, is in England, and will go to Egypt on the business of his firm.

Hon. J. M. Gibson, president of the Cataract Power Company, of Hamilton, refuses to say as yet whether the Street Railway Company will accept the city's proposition and install a new system. The company, he said, would give the city a price on the lighting plant on condition that Hamilton used Cataract power.

The Provincial Legislature of Ontario has passed a bill giving permission to tne Fort Erie Ferry Railway Company to extend their lines. The company propose to build an electric railway extending along the frontier from Chippewa to Port Colborne. Frank J. Weber, president of the company, states that work will commence on the construction of the road this year.

The power dam belonging to the town of Port Arthur, on the Little Current river, burst on the 27th ult., and completely demoralized the service of the town. The plant is owned and operated by the municipality. Fortunately, the Kaministiquia Power Company, at Fort William, were able to render immediate assistance with their large surplus of available power.

John Reid, of Virden, Man., has secured the contract, at $11,000, for the construction of telephone lines in the municipality of Wallace. There will be two hundred miles of galvanized iron wire to be erected, according to the original estimate, and this will connect some 300 subscribers. There are two exchanges in Wallace municipality, one at Virden and one at Elkhorn. Between these two the subscribers will be split up, giving both exchanges about the same number.

G. C. Hodge, district superintendent of the British Columbia Telephone Company, Limited, Nelson, B.C., has recently completed an inspection of the company's lines in the Boundary section. Some time ago the company decided to completely rebuild their lines in this section, and overhaul the local exchanges. The central office at Phoenix has been placed on a metallic circuit basis and long distance lines rebuilt. The inspection recently completed shows that this work has produced the desired results of reducing maintenance expenses, to say nothing of making it possible to furnish a greatly improved service.

MOONLIGHT SCHEDULE FOR JULY.

Date.	Light.	Date.	Extinguish.	No. of Hours
Jul. 1	8 00	Jul. 2	3 40	7 40
2	8 00	3	3 50	7 50
3	8 00	4	3 50	7 50
4	8 00	5	3 50	7 50
5	10 10	6	3 50	5 40
6	10 40	7	3 50	5 10
7	11 10	8	3 50	4 40
8	11 40	9	3 50	4 10
10	0 10	10	3 50	3 40
11	0 50	11	3 50	3 00
12	1 40	12	3 50	2 10
13	No Light	13	No Light	
14	8 00	14	10 00	2 00
15	8 00	15	10 50	2 50
16	8 00	16	11 30	3 30
17	8 00	18	0 00	4 00
18	8 00	19	0 30	4 30
19	7 50	20	1 00	5 10
20	7 50	21	1 30	5 40
21	7 50	22	2 00	6 10
22	7 50	23	2 30	6 40
23	7 50	24	3 10	7 20
24	7 50	25	4 00	8 10
25	7 50	26	4 00	8 10
26	7 50	27	4 00	8 10
27	7 50	28	4 00	8 10
28	7 50	29	4 10	8 20
29	7 50	30	4 10	8 20
30	7 50	31	4 10	8 20
31	7 40	Aug. 1	4 10	8 30
		Total	....	173 40

Sparks.

It is reported that the Bell Telephone Company are contemplating the erection of a $250,000 building at Toronto.

The International Lighting & Heating Company will erect three brick buildings for their new gas plant at Brandon, Man.

It is stated that the contract for the St. Mary's-London section of the North Midland Electric Railway will shortly be let.

The ratepayers of Ladysmith, B.C., have approved a by-law to borrow $25,000 for the installation of an electric light system.

The Toronto Electric Light Company will erect a sub-station at the northwest corner of Tecumseh and Defoe streets, Toronto.

The Saskatchewan Telephone Company, Moose Jaw, Sask., will shortly build to the boundary line, a distance of seventy five miles.

The town council at Macdonald, Man., have decided to proceed immediately with the construction of a municipal telephone system.

P. A. G. Rodrique has made an application to the city council of Calgary, Alta., for permission to construct a street railway system.

W. T. Croker, of Derloit, Mich., is negotiating with the city council of Galt with a view to the erection of a large automobile factory there.

The Eastview, Sask., Telephone Company are contemplating the erection of a number of rural telephone lines. R. E. Alleock is manager.

C. H. Mitchell, C.E., of Toronto, is investigating power projects for the town of Huntsville, Ont., and will report upon a hydro-electric installation.

A. T. Goward, manager of the British Columbia Electric Railway Company at Victoria, B.C., states that the concern will expend $2,000,000 upon extensions in and around that city.

At Estevan, Sask., it has been decided to submit a by-law to provide $83,000 for improvements and extensions to the electric light and water plants. Councillor Davis is interested.

W. W. Northcott, city purchasing agent, Victoria, B.C., will receive tenders up to June 15th for the supply and installation of two electrically driven pumps, also for supplying and laying steel rivetted pipes.

The city of Prince Albert, Sask., will replace the present electric lights with arc lights. It is proposed to turn the old electric light plant into a power house for a municipally owned electric street railway.

The C. P. R. are arranging to equip their line between New Westminster, B.C., and Westminster Junction, to be operated by electricity, early next year. F. E. Bustced, Vancouver, B.C., is general superintendent.

K. L. Aitken, consulting engineer, Toronto, has submitted to the town council of Merriton, Ont., his estimate of the cost of an electric light plant to be owned by the municipality. The total expenditure involved is $4,207.

The contract for the 500 kilowatt steam turbine generating unit for the town of Moose Jaw, Sask., has been awarded to the Canada General Electric Company at $36,431. Allis-Chalmers-Bullock also tendered at $45,754 and the Canadian Westinghouse Company at $45,054.

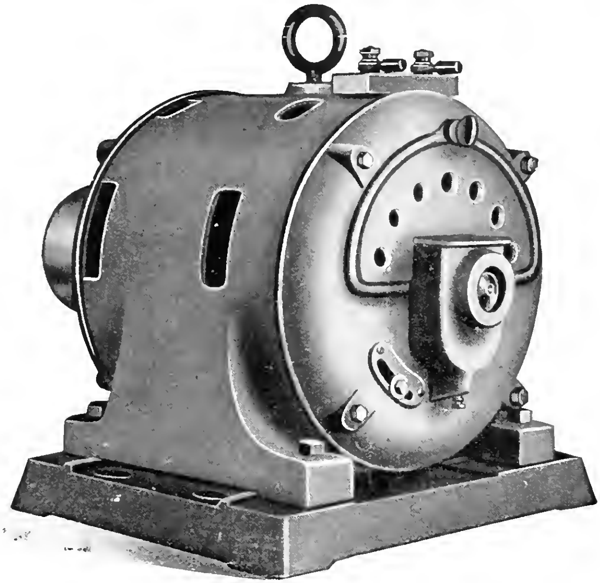
PRINGLE SINGLE PHASE MOTOR

Self Starting Under Full Load.

Entirely Automatic and Practically Noiseless.

Most Economical to Operate.

Complete Line from ¼ to 10 h.p. for Frequencies between 25 and 140 Cycles.



Can be operated on both Single and Multiphase Circuits with Equal Results.

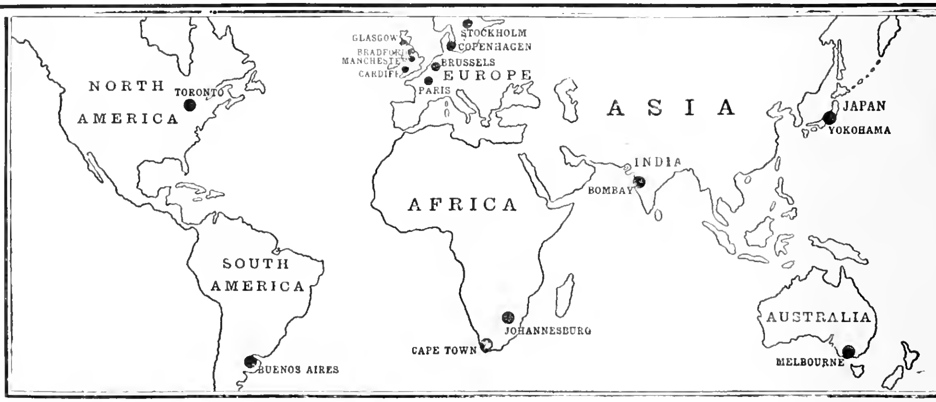
High Power Factor and Efficiency.

Develops a Heavy Starting Torque and Accelerates Quickly.

Absolute Proof of these Claims and Further Details are yours for the asking.

May we send them?

The R. E. T. PRINGLE CO., Limited, Montreal, Que., Winnipeg, Man.



For Locating Defective Wiring.

THE SUN NEVER SETS on EVERSHED'S MEGGER

For Testing at Working Pressure.

MEGGERS are kept in stock by agents at all the cities indicated on the above map.
A Large Stock always on hand at the office of

J. F. B. VANDELEUR, Canadian Agent

See Page 36.

For Contractors to the Admiralty, War Office, Etc.

Meggers are used by the Canadian Fire Underwriters

No. 3 Dineen Building, TORONTO

CANADIAN
ELECTRICAL NEWS
& ENGINEERING JOURNAL

PUBLISHED ON THE FIFTH OF EVERY MONTH BY
HUGH C. MACLEAN, LIMITED,
TORONTO, CANADA

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362

MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative

WINNIPEG - - - - Telephone 224. 404 Travellers Bldg
ROLAND F. HILL, Representative

VANCOUVER - - - - Telephone 2248. 615 Hastings St.
GEO. A. GALL, Representative

ADVERTISEMENTS.

Advertising rates sent promptly on application Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.

The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

A Successful Convention.

From every viewpoint, the recent convention of the Canadian Electrical Association was a pronounced success. It was predicted, logically, that the prevailing disposition in business circles to confine expenditures to actual necessities would be reflected in a smaller attendance. On the contrary, however, the number of persons registered was surprisingly large, being almost as great as in Montreal last year, when the Electrical Exhibition was in progress. Another very gratifying feature of the convention was that the larger percentage of those present were to be found in the meeting room while the papers were being read and discussed. Never in the history of the Association were the business sessions so well attended. This is an indication of a growing interest in the Association and what it can accomplish for its members.

The program of papers was good. What might be termed commercial subjects brought forth very valuable discusion. The legal papers contributed by two leading members of the bar served to illustrate the fact that there is a multiplicity of questions and conditions on which someone desires to be enlightened. The illustrated lectures were no less appreciated. The demonstration of the working of the Oscillograph, a marvellous device for indicating the electric current waves, was a revelation to many of the members.

The Association was again fortunate this year in having a presiding officer who is thoroughly in touch with operating conditions and who is ever on the alert to protect and advance the interests of the electrical fraternity. Mr. Kelsch's participation in the discussion of the papers had a helpful influence and served to widen the scope of the discussion. His efforts in the direction of infusing greater activity into the Association between conventions is also to be commended. Committee work should be carried on more vigorously and more systematically. The movement for a reduction in the meter inspection fees should be continued, and committees appointed to report on such questions as rates, the fire hazard of electricity, underwriters' rules, punishment for theft of current, etc.

An interesting feature of the convention this year was the exhibit of electrical apparatus. Considering that the decision to have such exhibits was reached less than three weeks prior to the convention, and that in consequence many firms were not represented, the result was very satisfactory. The plan should be continued.

The arrangements for the convention reflected credit on the Local Committee. The meeting place was ideal, removed from the throngs of the business district, but easy of access and possessing all essential accommodation. The example is worthy of emulation on future occasions. The entertainment provided was pleasing to all.

The meeting place of the next convention will be decided by the Managing Committee, after having obtained an expression of opinion from the members. Ottawa, Quebec, Montreal and Niagara Falls have been mentioned. A decision being reached, the plans for the convention should receive early consideration, especially in respect to the papers. It is a distinct advantage to have the papers printed and distributed in advance of the convention, that members may become familiar with them, make marginal notes, and come to the convention prepared to discuss them. In this way only can the maximum amount of benefit be derived.

Let every member do his utmost during the coming year to advance the interests of the Association, and this effort will be reflected in the 1909 convention.

An Important Advance in Lamps.

The possibility of a more efficient lamp than the "Tungsten" and other high efficeney lamps is a matter of the greatest importance. This was referred to by President Kelsch in his address before the C. E. A. convention last month. He stated that he expected, a little later, to see a modified carbon filament lamp of greater life, efficiency and candle power than the present lamps, having their filaments made of some modified form of carbon. A serious consideration in connection with such lamps will be the matter of the grounding of secondaries. It is quite possible that this class of lamp, which is now almost ready to be placed upon the market, will be suitable for 220 volts. The more generally accepted limit at present for the grounding of alternating current secondaries is 150 volts. Mr. Kelsch believed this limit of pressure too low. The introduction of the new 220 volt lamps may make it necessary for the Underwriters' Association to consider seriously the matter of extending the limit. It is understood that the new lamps referred to by Mr. Kelsch have the remarkable feature that the filament can be heated to incandescence in the open air and resist attack for quite a long period of time. It is said the increased cost of this filament is offset by the saving due to its needing a lower vacuum.

The Canadian Electrical Association Convention

The eighteenth annual convention of the Canadian Electrical Association, which was opened in the Chemistry and Mining Building of the University of Toronto, on Wednesday, June 17th, and continued until Friday, June 19th, was one of the most successful and well attended that has yet been held.

Those Who Were Present.

The following are the members who attended the convention:

J. G. Archibald, Woodstock Water & Light System, Woodstock, Ont.
S. S. Anderson, Sandwich, Windsor & Amherstburg Railway & Light Co., Windsor, Ont.
B. F. Anderson, Canadian Westinghouse Company, Montreal.
W. L. Adams, Ontario Power Company, Niagara Falls, Ont.
W. M. Andrew, Canadian Westinghouse Company, Toronto.
J. C. Armer, Canadian Machinery, Toronto.
J. M. Allen, Toronto Electric Light Company, Toronto.
P. Alexander, Alexander & Mills, Peterborough.
Prof. R. W. Angus, University of Toronto.
H. S. Brown, Canadian General Electric Company, Toronto.
T. Beecroft, Barrie Electric Light Plant, Barrie, Ont.
E. F. Brough, Nicholls Chemical Company, Sulphide, Tweed, Ont.
R. G. Black, Toronto Electric Light Company, Toronto.
J. H. Bennett, Electric Light Plant, Barrie, Ont.
Acton Burrows, Railway and Marine World, Toronto.
Valentine Boyd, Canadian General Electric Company, Toronto.
N. S. Braden, Canadian Westinghouse Company, Hamilton.
W. H. R. Burrows, Toronto Electric Light Company, Toronto.
H. C. Breay, Cully & Breay, Hamilton.
William A. Bucke, Canadian General Electric Company, Toronto.
H. Boultbee, "Canadian Electrical News," Toronto.
H. M. Bostwick, Canadian Westinghouse Company, Hamilton.
G. D. Bly, Monarch Supply Company, Toronto.
W. B. Boyd, Toronto Railway Company, Toronto.
Geo. C. Burnham, Allis-Chalmers-Bullock, Toronto.
H. H. Beasley, Toronto Railway Company, Toronto.
H. A. Burson, Packard Electric Co., St. Catharines, Ont.
James Bicknell, Bicknell & Morine, Toronto.
J. Cave, Canada Foundry Company, Toronto.
F. A. Chisholm, St. Johns Electric Light Company, St. Johns, Que.
Alfred Collyer, Alfred Collyer & Company, Montreal.
G. Campbell, Robert Simpson Company, Toronto.
P. S. Coate, Chatham Gas Company, Chatham, Ont.
H. D. Crouch, Northern Electric & Manufacturing Company, Montreal.
M. J. Clancy, John Ritchie Company, Toronto.
S. B. Condit, Jr., American Conduit Company, Boston, Mass.
John F. Cody, Queen City Oil Company, London, Ont.
R. J. Clark, Toronto Railway Company, Toronto.
O. A. Cole, Philip Carey Manufacturing Company, Toronto.
W. G. Chace, Smith, Kerry & Chace, Toronto.
H. R. Carruthers, Alvinston Power Co., Alvinston, Ont.
G. Percy Cole, Allis-Chalmers-Bullock, Montreal.
E. E. Cary, Edward E. Cary Co., Inc., New York.
J. A. Culverwell, Northumberland-Durham Power Company, Port Hope, Ont.
A. A. Dion, Ottawa Electric Company, Ottawa.
J. B. Dougall, Electric Light Plant, Barrie, Ont.
R. J. Dunlop, Canadian Westinghouse Company, Toronto.
T. F. Dryden, Canadian Westinghouse Company, Toronto.
H. Stanfield Dodd, Gas & Electric Power Company, Toronto.
Fred. Deagle, Georgian Bay Power Company, Eugenia Falls.
J. M. Deagle, Cataract Electric Company, Orangeville, Ont.
W. F. Dean, Canadian General Electric Company, Toronto.
Saul Dushman, University of Toronto.
W. H. Eisenbeis, Canadian Westinghouse Company, Toronto.
W. L. Earl, Oneida Community, Limited, Montreal.
H. O. Edwards, Canadian General Electric Company, Toronto.
A. E. Esling, Canadian General Electric Company, Toronto.
H. O. Fisk, Peterboro Light & Power Company, Peterborough.
T. R. Fulton, Eugene Phillips Electrical Works, Montreal.
J. A. Fletcher, R. E. T. Pringle Company, Montreal.
A. E. Fleming, Canadian Westinghouse Company, Hamilton.
James Fisher, "Canadian Electrical News," Toronto.
A. F. Fifield, Electrical Contractor, St. Catharines, Ont.
H. T. Gibbs, Canadian Westinghouse Company, Toronto.
G. T. Goddard, Moloney Electric Company, St. Louis, Mo.
R. E. Gallagher, New York.
George Grosz, Electric Light Plant, Waterloo, Ont.
W. W. Grant, American Conduit Company, New York.
Lawford Grant, British Insulated & Helsby Cables, Ltd., Montreal.
J. G. Glassco, Dominion Power & Transmission Company, Hamilton.
E. A. Greene, Joyner-Greene Company, Toronto.
R. Greeniaus, Toronto Electric Light Company, Toronto.
Dr. Galbraith, Principal School of Practical Science, Toronto.
A. W. Givin, Canadian Fairbanks Company, Toronto.
J. Herbert Hall, Conduits Company, Limited, Toronto.
A. T. Hicks, Trenton Light & Water Company, Trenton, Ont.
P. N. Hover, New York Insulated Wire Company, New York.
H. W. Heise, Central Electric & School Supply Co., Toronto.
P. E. Hart, Canadian General Electric Company, Toronto.
Charles B. Hunt, London Electric Company, London, Ont.
A. O. Hunt, London Electric Company, London, Ont.
A. C. Haight, Canadian General Electric Company, Toronto.
A. Henrion, Canadian Westinghouse Company, Hamilton.
R. B. Hamilton, Packard Electric Company, St. Catharines.
D. F. Hills, Gas & Electric Power Company, Toronto.
H. E. Hunter, Canadian General Electric Company, Toronto.
E. Irving, Sunbeam Incandescent Lamp Company, Toronto.
E. J. Jenking, Canadian General Electric Company, Toronto.
James Johnston, Public Works Department, Ottawa.
J. H. Jenkins, General Electric Company, Schenectady, N.Y.
F. S. Joy, Canadian Machinery, Toronto.
E. A. ames, Canadian Engineer, Toronto.
H. W. Jutton, Canadian Westinghouse Company, Hamilton.
R. S. Kelsch, Montreal Light, Heat & Power Co., Montreal.
E. J. Kyle, Merrickville Electric Light & Power Company, Merrickville, Ont.
J. P. King, Stratford Gas Company, Stratford, Ont.
George C. Knott, Benjamin Electric Company, Toronto.
Walter Knight, Knight Bros. Company, Burk's Falls.
John Knox, Dominion Power & Transmission Company, Hamilton.
H. E. M. Kensit, Smith, Kerry & Chace, Toronto.
A. N. Kurchmann, Cement & Concrete Review, Toronto.
H. P. Kimball, Standard Underground Cable Co., New York.
A. B. Lambe, Canadian General Electric Company, Toronto.
W. W. Lovell, Canadian Westinghouse Company, Toronto.
J. D. Lachapelle, Eastern Electrical Engineering Co., Montreal.
W. H. Lytle, Canadian Machine Telephone Co., Brantford, Ont.
T. J. Lynch, Allis-Chalmbers-Bullock, Toronto.
J. H. Larmouth, Peterborough Light & Power Co., Peterborough.
Alfred Landaw, Electric Specialties, Limited, Toronto.
D. Logan, Toronto Electric Light Company, Toronto.
C. W. Lee, C. W. Lee Company, New York.
W. Lang, Knight Bros. Company, Burk's Falls, Ont.
A. T. Laing, University of Toronto.
G. D. Leacock, John Forman Company, Montreal.
W. L. Macfarlane, St. Lawrence Power Co., Cornwall, Ont.
W. McCaffrey, Canadian General Electric Company, Toronto.
F. A. Mahoney, Canadian General Electric Company, Toronto.
John Murphy, Electrical Engineer Dominion Government, Ottawa.
William McKay, Robb Engineering Company, Toronto.
J. W. McLennan, Lindsay Light, Heat & Power Company, Lindsay, Ont.
Paul J. Myler, Canadian Westinghouse Company, Hamilton.
C. H. Mitchell, C.E., Toronto.
Hugh C. MacLean, Hugh C. MacLean, Limited, Toronto.
A. F. McBean, Western Counties Electric Company, Brantford.
J. G. Monahan, Gas & Electric Power Company, Toronto.
E. D. McCormack, Canadian General Electric Co., Toronto.
John F. S. Madden, Canadian General Electric Co., Toronto.
A. W. McKinlay, Federal Electric Construction Co., Toronto.
John McVittie, Saugeen Light & Power Co., Southampton.
H. A. Moore, Canada Foundry Company, Toronto.
Ed. Mole, Seaforth Electric Light Company, Seaforth, Ont.
E. G. Mack, Crouse-Hinds Company, Syracuse, N.Y.
J. R. McLinden, Electric Light Department, Owen Sound.
D. O. McKinnon, Canadian Manufacturer, Toronto.
C. H. Mortimer, Toronto.
G. C. Mooring, Toronto.
F. A. Merrick, Canadian Westinghouse Company, Hamilton.
C. A. McLean, Canadian Westinghouse Company, Toronto.
D. M. McCargar, Belleville Portland Cement Co., Belleville, Ont.

G. W. Megan, "Canadian Electrical News," Toronto.
C. R. McKay, Toledo Railway & Light Co., Toledo, Ohio.
D. H. McDougall, Toronto & Niagara Power Company, Toronto.
J. McMurchy, Brampton Electric Light Co., Brampton, Ont.
C. S. Manchester, Electrical Superintendent Welland Canal, St. Catharines, Ont.
Robert McKay, Johnston, McKay, Dodds & Grant, Toronto.
H. G. Nicholls, Canadian General Electric Company, Toronto.
Raymond Noyes, Oneida Community, Niagara Falls, Ont.
Walter Northgraves, Waterloo Electric Light Co., Waterloo, Ont.
Henry Oestreich, Electrician Joseph E. Seagram, Waterloo, Ont.
T. R. Price, Sunbeam Incandescent Lamp Company, Toronto.
T. J. E. Papineau, Toronto Electric Light Company, Toronto.
J. W. Purcell, Hiram Walker & Sons, Walkerville, Ont.
J. W. Putnam, Toronto & Niagara Power Company, Hamilton.
C. U. Peeling, Municipal Plant, Campbellford, Ont.
A. S. L. Peaslee, Canadian Westinghouse Company, Toronto.
W. A. Pearson, Toronto Niagara Power Company, Niagara Falls.
S. Plewes, Creemore Electric Light Company, Creemore, Ont.
John T. Potter, Walkerton Electric Light Co., Walkerton, Ont.
H. W. Price, University of Toronto.
E. J. Phillips, Electric Light Plant, Berlin.
R. J. Smith, Canadian Electric & Water Power Company, Perth.
M. H. Smith, Canadian Westinghouse Company, Toronto.
A. H. Stone, Wanapitae Power Company, Sudbury, Ont.
A. D. Smith, Federal Electric Construction Company, Toronto.
E. F. Stoll, Universal Manufacturing Company, Toronto.
E. Smith, Municipal Electric Light Plant, Gravenhurst, Ont.
D. F. Streb, Municipal Electric Light Plant, Collingwood, Ont.
J. H. Sloan, Municipal Electric Light Plant, Tottenham, Ont.
B. F. Selby, Canadian General Electric Company, Toronto.
Thomas Stewart, Light, Heat & Power Company, Lindsay, Ont.
S. W. Smith, Electrical Enigniering Company, Montreal.
George J. Stanley, Northern Aluminum Company, Rochester.
R. A. Stinson, Canadian Crocker-Wheeler Company, Montreal.
J. E. Skidmore, Cobourg Utilities Corporation, Cobourg, Ont.
J. J. Salmond, Canadian Engineer, Toronto.
Frank C. Smallpiece, Canadian General Electric Company, Toronto.
A. G. Sangster, Lincoln Light & Power Company, St. Catharines.
F. W. Snider, Waterloo Electric Company, Waterloo, Ont.
J. P. Thompson, Eugene F. Phillips Electrical Works, Toronto.
J. F. B. Vandeleur, Evershed & Vignoles, Limited, Toronto.
B. Vanwinkle, Canadian Fire Underwriters, Toronto.

Members of the Canadian Electrical Association on the steps of the Convention Building.

B. F. Reesor, Georgian Bay Power Company, Lindsay.
W. N. Ryerson, Ontario Power Company, Niagara Falls, Ont.
T. R. Rosebrugh, University of Toronto, Toronto.
F. Rose, Canadian General Electric Company, Toronto.
W. E. Reesor, Light, Heat & Power Company, Lindsay, Ont.
W. R. Reynolds, Water, Heat & Light Commission, St. Marys.
Norman S. Richards, Canadian General Electric Co., Toronto.
Joseph Rogers, Rogers Electric Company, Toronto.
F. Ryan, Electric Supply Company, Hamilton.
J. B. Rathbun, Belleville Portland Cement Company, Belleville.
G. H. Rolland, Allis Chalmers-Bullock, Toronto.
Herbert Rice, The Cutter Company, Philadelphia, Pa.
J. A. Shand, Allis Chalmers-Bullock, Limited, Toronto.
Chas. A. Smith, Hamilton Anchor Company, Hamilton.
Irving Smith, R. E. T. Pringle Company, Montreal.
H. F. Strickland, Canadian Fire Underwriters' Association, Toronto.
W. Wray Staight, Toronto.
A. Sangster, Gas & Electric Department, Sherbrooke, Que.
C. W. Stokes, Harpell-Stokes, Limited, Toronto.
F. G. Vaughen, General Electric Company, Schenectady, N.Y.
E. B. Walker, Canadian General Electric Company, Toronto.
H. Webster, Electric Light Plant, Norwich, Ont.
W. J. Wyles, Municipal Plant, Wingham, Ont.
R. S. Wilson, Electric Light Plant, Oakville, Ont.
J. J. Wright, Toronto Electric Light Company, Toronto.
J. A. Woodman, Hamilton.
C. H. Wright, Canadian General Electric Company, Ottawa.
T. C. Walsh, Devean Telephone Manufacturing Company, N. Y.
John Wilson, Water & Light Commission, Collingwood.
Geo. W. Watts, Canadian General Electric Company, Toronto.
Geo. Williams, New York.
W. Williams, Sarnia Gas & Electric Company, Sarnia, Ont.
Alvan L. Woolf, Midland Electric Company, Montreal.
A. M. Wickens, Canadian Casualty and Boiler Insurance Company, Toronto.
P. Whatmore, Electrical Specialities Limited, Toronto.
P. B. Yates, Gould Storage Battery Company, Toronto.
T. S. Young, Secretary treasurer Canadian Electric Association, Toronto.

The president, Mr. R. S. Kelsch, opened the meeting on the first day with a brief speech and was followed by Alderman Graham, in the absence of the Mayor who welcomed the delegates on behalf of the City of Toronto.

The president in his address expressed his great pleasure at welcoming the members and their guests at the sixth meeting held in Toronto. The first meeting at which the Association was formed was held in Toronto in 1891, when there were twenty members present, several of whom were still with them. To-day the membership was four hundred. Since the last meeting, held in Montreal, they had passed through some trying ordeals, due to the financial panic. When called to a halt in October last, they had been travelling at a rapid pace. In many instances it was no longer a question of the cost of apparatus. Delivery was often the most important point in deciding upon the reward of a contract. Such conditions could have but one ending and the check received might have been for the best.

It was interesting to know that statistics prepared by one of the large railway systems, operating both electric and steam service showed that the electric system had stood the test of financial depression better than the steam system. During December, 1907, eighteen electric railways increased their earnings two per cent. over the same month in 1906. In the same month sixty-one steam roads decreased 4.28 per cent. These figures were very gratifying to those who were engaged in electric railway work.

Referring to the fear formerly felt that the new types of

W. N. Ryerson, Niagara Falls, President Canadian Electrical Association.

Tungsten and other high efficiency incandescent lamps might reduce the income of lighting companies, Mr. Kelsch said that it had been shown that the consumption of incandescent lamps during the past year amounted to over 85,000,000 and that for the next twelve months the visible supply of new high efficiency lamps was less than $2\frac{1}{2}$ per cent. of the demand.

Speaking of the competition of gas companies Mr. Kelsch told of a case in which a lighting company had secured permission to fit up a store with Tungsten lamps and in less than sixty days after the first store was lighted, they secured a contract to light the same company's other twenty-one stores, which formerly had been lighted by gas. Any reduction in the income of central stations due to the use of Tungsten lamps, would be more than offset by new revenue made possible by this lamp. He looked forward to the appearance of an incandescent lamp of high efficiency type equal in candle power to the present street arc lamp but of higher efficiency power factor, and procured at one quarter the first cost. He also expected to see perhaps a little later, a modified carbon filament lamp of greater life, efficiency and candle power than the present lines, which would have their filaments made of some modified form of carbon, and costing about fifteen cents retail for a 20 to 50 candle power lamp.

The National Electric Light Association had recently adopted a resolution upon the grounding of secondaries, making it compulsory to ground alternating current secondaries up to and including 150 volts, and prohibiting the grounding of alternating current secondaries carrying an excess of 150 volts. These rules were used by the Canadian Fire Underwriters' Association and the whole question was one of the greatest importance to the Association. To his mind the limit of pressure was too low at 150 volts.

Reference was then made to the importance of the question of rates, which as far as he knew had received little or no attention from the Association. The time was fast approaching when some form of control by commission would govern their acts. They should take time by the forelock, study the matter and act in such a way that the commission would have little or no work to do.

President Falconer of the University of Toronto, then addressed a few words of welcome to the meeting.

Secretary-Treasurer's Report.

The secretary-treasurer's report was then read by Mr. T. S. Young, and is given in part below:

The year has witnessed a substantial increase in membership. One hundred and twenty new members joined during the year, while twenty-seven names were removed as the result of resignations and other causes, making a total membership on May 31, 1908, of 395, an increase of 92 members as compared with the corresponding date of 1907. Several of the resignations were due to the removal of the members to other countries. A special effort has been made during the past twelve months to interest a larger number of the private lighting and power companies in the Association, and I am glad to say that it has met with some sucess. One year ago there were represented in the Association by individual membership seventy private companies, while the present membership represents ninety-two of such companies, a showing for one year which I think may be considered satisfactory. The advantages of organization are becoming more generally recognized, although there are still a number of companies who are satisfied to profit from the united efforts of the Association without bearing their burden of the work and expense.

The membership fees collected during the year amounted to $945. In this connection I would urge that members who do not desire to continue their membership should notify the secretary to that effect in accordance with the constitution, instead of allowing their names to remain on the register until removed by direction of the managing committee.

The plan suggested by Mr. A. A. Dion at the last convention for the continuance of the Question Box was approved, and at the unanimous request of the committee, Mr. Dion consented to act as chief editor. The great advantage of the new plan, with which most of our members are no doubt familiar, is the fact that answers to questions may be obtained promptly instead of waiting for the publication of the Question Box. The time has been too short to give the new plan a fair trial, and we may reasonably anticipate a growing interest in this movement to benefit the members of the Association.

At our last convention, a committee, consisting of Messrs. A. A. Dion (chairman), R. S. Kelsch, J. J. Wright, J. M. Robertson and A. A. Wright, M. P., was appointed to memorialize the Dominion Government for a reduction in the fees charged for the inspection of electric light meters. By request of the chairman, I beg to report that this committee met in Montreal on November 8th, when it was decided to elicit the support and co-operation of all the lighting companies in the movement. Subsequently, largely through the efforts of Mr. R. S. Kelsch, the Canadian Gas Association was organized, and a joint deputation representing the two associations interviewed the Right Honorable Sir Wilfrid Laurier and Hon. Mr. Templeman, Minister of Inland Revenue, at Ottawa on February 12th, 1908. Most of the larger lighting companies were represented. The delegation was introduced by Mr. Dion and most cordially received. The memorial submitted pointed out that the charges made by the government for the inspection and testing of electric and gas meters had resulted in an excess of revenue over expenditures of $153,046.85 in seven years and nine months. The Minister of Inland Revenue admitted that the Dominion Government had no desire to make a profit out of the service and stated that the registration fee would be abolished immediately. An order in council, dated March 14th, 1908, was therefore issued abolishing from the 1st of April the registration fees established under the provisions of section 10 of the Electricity Inspection Act. This abolition means a saving of about $6,000 a year to the lighting companies.

The decision of the Government in respect to a reduction of the fees for testing of meters is set forth in a letter from Hon. Mr. Templeman to our president, Mr. R. S. Kelsch, in which he says: "With regard to the inspection fees, we have decided to wait for some time, in order to ascertain how the revenue

and expenditure will balance, after having carried out certain contemplated improvements in the service. The policy of this department is to make the service self-sustaining, not to produce a prifit.'' It is understood that the minister is of the opinion that it will take a year or more to ascertain if, under changed conditions, there will still be a surplus. It would seem, however, that the lighting companies may reasonably anticipate a reduction in the fees for the testing of large meters, the cost of verifying which is no greater than a small meter.

The report closed with a recommendation for abolishing or reducing the duty of 35 per cent. on carbons, as apparently none had been made in Canada for some years. The duty at present paid amounted to about $14,000 a year.

The auditors, Messrs. R. G. Black and W. J. McKinlay, reported that they had examined the cash book and vouchers of the secretary-treasurer and found them correct.

Mr. A. A. Dion referred to the matter of meter inspection fees, pointing out that $153,000 had been collected by the Government illegally as shown by their own act which stated that the service should be self-sustaining. In spite of this a profit had been reaped which ought to be immediately drawn upon in order to bring about a reduction of the fee. It was a question whether the Government should not be interviewed again rather than wait for another year.

The president agreed with this proposal and the report of the secretary-treasurer was then adopted.

Dr. Galbraith Dean of the Faculty of Applied Science of the University of Toronto entered the meeting at this stage and was given a hearty welcome. He delivered a brief address of welcome to the Association.

Discussion on Mr. Ryerson's Paper.

Mr. W. N. Ryerson's paper upon ''Power Rates and Factors,'' which is published on page 22 of this issue, was then read.

At the conclusion of his paper Mr. Ryerson said that the method mentioned in connection with the minimum payment per horse power of connected load for the period of charge was set forth in a pamphlet issued by the Union Electric Light & Power Company of St. Louis, Mo. The scale maintained by them would probably reduce the price, with the discount allowed, to an absurd figure. The method might be adjusted, however, to take care of almost any amount of power after carefully adjusting the rates.

Since the preparation of his paper a very fair maximum demand meter had been brought out by one of the manufacturing firms, which was connected to an ordinary intergrating watt meter mechanism. A small hand travelling over a dial being moved by the revolving disk, registered the maximum rate of

R. M. Wilson, Montreal, First-Vice-President Canadian Electrical Association.

consumption. The time for which that maximum lasted might be adjusted by increasing or decreasing the drag magnets on the disk. This form of meter was independent of the power factor.

The sliding scale method of charging was not economical from the meter standpoint. In small blocks of power it required an intergrating watt meter. An instrument had been developed which combined to a certain extent these two meters, the constant or ordinary intergrating watt meter, having attached to it a printing device which stamps on a piece of paper the maximum one minute peak or other load during one day. Then it added the peaks and at the end of the month it was necessary only to divide the sum of daily peaks by the number of peaks to give the daily average. Then the kilowatt hours were read directly on the dial.

The President in opening the discussion upon Mr. Ryerson's paper said that a maximum demand meter had been brought out by the Boston Edison Company, consisting of an ordinary

P. S. Coate, Chatham, Second-Vice-President Canadian Electrical Association.

watt meter with an attachment for recording the revolutions per minute or half minute, to accomplish the same purpose as the instruments described by Mr. Ryerson. He had found trouble in checking the power factor or making a rate that would meet all conditions. He had seen contracts which read that the rate per horse power was say $10, based on the minimum power factor of 90 per cent., and in the event of the factor falling below that the horse power to be paid for was to be determined by the volts between the phases. For instance, take one phase, .1732 divided by .90, a condition often met wth. There was no instrument on the market to take care of that condition. Such contracts had to be made. In one case he knew of, a cement company in Ottawa after finding that its power factor was 73, paid $10,000 for a synchronous condenser to raise the power factor to 90 per cent., the terms of the contract.

Mr. Dion said that the flat rate, if low enough, was the most popular with the consumer, but it was difficult to adjust. It was impossible to apply a flat rate without some form of curve drawings to record what was actually going on, and in many cases it was not commercially advisable to use a curve drawing instrument on account of its cost and the small units dealt with. Taking all points into consideration he believed that for the sale of small units, the meter rate together with a flat rate, based on the total installation and the size of the motor, was the nearest thing to meeting conditions properly without running into complications.

Mr. R. G. Black, Toronto, said that one of the most difficult cases was where an operating company would have to sell from 50 to 200 horse power to some manufacturing concern using a large number of motors. The company had to guard against a large capital expenditure in case they ran all their motors at one time, and against a very low power factor in case they installed very small units and ran them under load. The method of making rates was much more difficult for A. C. than for D. C. services. The questions of power factor and other troublesome features were all eliminated in D. C. services.

The President, referring to the case of the Montreal Street Railway Co., to which power was sold in a 12,000 horse power lot, said that the conditions in that contract were that the customer must not exceed the amount purchased by more than 10 per cent. for more than two minutes. The street railway com-

pany had been unable to meet these conditions until they installed a storage battery, since when there had been no trouble.

Mr. C. R. McKay, Toledo, said that his company in adjusting power rates had for some years adhered to the practice of charging a fixed amount for large installations, so as to cover the fixed annual charges on the investment, necessary to take care of the consumer's maximum demand. He thought that in the case of small installations of 100 horse power, or even less, the matter could be settled by making factory tests. In cases of 25 horse power or less they usually charged simply so much a year on the basis of the connected horse power. One company within the last seven or eight months had had to spend something like $40,000 to rectify the low power factor under which they operated. They had increased their power load by nearly 75 per cent. in a year and a half, and at the end of that time they were having to instal additional capacity to take care of the little power factors. Even then they were having trouble with over heating and their power factor ran nearly all day long as low as 65 per cent. The means they had adopted were the usual ones of installing condensers in their sub-stations and in some cases on the consumer's premises.

Nearly all large stations now, were installing good sized storage batteries or motor generator sets with sufficient fly

T. J. Lynch, Chairman Entertainment Committee for the Canadian Electrical Association Convention.

wheel capacity to reduce their maximum demand materially. It would cost them $25,000 to $30,000 to do this, but it was necessary for them to do so if they were to secure the benefit of any reduction in their fixed charges.

Mr. Dion explained that he did not advocate a flat rate. The flat rate was only to cover the cost of the capital invested and the balance of the charge was a meter charge.

Mr. Black thought Mr. Dion's method a very good one, but it was difficult to apply, especially in large plants. If large plants were charged on the installed capacity it would be very hard to get them to live up to it.

Mr. Dion replied that he did not believe they could adopt any rate universally. As a rule, however, the one he had suggested would be nearly right.

Mr. W. Wray Staight, Toronto, formerly of London, Eng., said the power rates in England were mostly flat rates based upon the size of the motor. He believed the small consumer in the old country would haggle over rates more even than in this country. The question was much less settled over there than here.

At the afternoon meeting the first paper read was by Mr. George Williams on "How to Increase the Station Load." This address, which was illustrated by lantern slides, will be published in a future issue of the "Electrical News." Mr. Williams also followed his paper with an explanation of a number of stereopticon views of electrical signs for use at night and for outline lighting. A lengthy discussion also followed these remarks, which will be reported in a later issue.

The following papers were then read and discussed extensively: "Lost and Unaccounted For Current," by C. R. McKay, Toledo, Ohio; "Various Electrical Power Plants by European Designers," by C. H. Mitchell.

On Thursday morning the meeting was opened by the reading of a paper on "Modern Street Lighting," by A. E. Fleming, which was followed by a lengthy discussion. It will be published in a future issue of the "Electrical News."

Mr. W. G. Chace, Toronto, was to have delivered a paper on "Regulation of Electric Currents and Circuits." Unfortunately he was called away at the last moment but expected to present his paper later. He was unable to do so, however, and Mr. Black having obtained Mr. Chace's slides, gave a general description of circuit regulators so as to open the discussion. The slides were put through the lantern.

Mr. W. A. Bucke's paper on "Revenue per Capita from Electric Plants," which is published on page 24 of this issue, was the next to be presented. It was listened to with interest and Mr. Bucke was complimented by the President and Mr. Dion upon the useful statistics which he had compiled. It was regrettable, Mr. Dion said, that a large number of companies had not responded more generously to Mr. Bucke's appeal for statistics. There was no way in which they could tell, except by comparison of this kind, whether they were doing justice to their plants. This fact was so important that the National Electric Light Association, he believed, published an annual report of this kind. It would be very desirable if the Canadian Electrical Association could do the same. It would be a good thing if Mr. Bucke, who had commenced so well, would continue to carry on this work with the help of the committee on statistics.

At the Thursday afternoon session Mr. James Bicknell of Toronto, read a paper on "Electrical Franchises, Their Legal Status and Basis of Valuation." Mr. Bicknell's paper is published on page 19 of this issue. It was followed by a lengthy and interesting discussion, during which Mr. Bicknell answered a number of questions by members.

In answer to the President, Mr. Bicknell said that if a transmission company erected a pole through the telephone wires of a telephone company, which had been in place for ten or twelve years, and if, say at a height of ten feet above the telephone wires, they placed dangerous wires carrying say 33,000 volts, the transmission company would be bound to adopt precautions to make the telephone line reasonably safe.

Replying to Mr. Dion, Mr. Bicknell said that a municipality could not expropriate the property of a company having a perpetual franchise under a by-law passed by the municipality, without the consent of the company, even though the company were compensated. The Hydro-Electric Commission had power to expropriate certain companies at the present time, and it was possible for a municipality to obtain special legislation, but they could not expropriate in the manner suggested, under any general act.

In answer to J. H. Larmouth, Peterboro, Mr. Bicknell said, if a municipality wished to expropriate an electric plant it must take all or none. To another question by Mr. Larmouth he said that probably if a transmission line crossed the corner of a lot and had been there for twelve or fourteen years, it would have a right to continue there. The statute upon this point, however, was drawn very carelessly. Probably if the wire stayed there for twenty years, an "easement" would be acquired, and the landowner would have no right to take it down. In 1904 an Ontario Act prevented telephone and telegraph companies from obtaining "easement" by any length of years, but there was no similar legislation with regard to electric light companies. This was probably an oversight, and it might be expected that the legislature would amend it, as soon as it is pointed out to them. If a case came into court at present, and the electric light company had had twenty years' use, it would be declared to have the right to continue. Under twenty years, it would be no good.

Replying to a question by Mr. Black, Mr. Bicknell said that unless there was some actual injury about to be suffered by a railroad company in connection with its telephone line, no redress could be obtained from a transmission company whose lines ran parallel to the railway company's lines. Electricity was like a dangerous animal and if it escaped and caused damage the owner would be liable. This was the ordinary principle but whether the use of a transmission line so near the border as to cause damage to the adjoining proprietor, using wires for telephone purposes, would be an unusual or improper user of the land and would entitle the railway company to get out an injunction restraining the transmission company from continuing to transmit power so close to the railway company's land, was a very difficult question. He did not know how it would be answered.

In answer to Mr. F. A. Chisholm, St. Johns, Que., Mr. Bicknell said that in the case of two private companies running in competition, one of which became insolvent, the town could not buy it in at an auction, and then compete with the other company. If the town went into the electrical business it had to acquire the property of any company carrying on the business of lighting its streets. If the company which had carried on street lighting became insolvent, possibly the town might if it had the necessary power from the ratepayers go into the business without buying out the other, and compete with it. But this was never done in street lighting. If they had already been doing street lighting the Conmee Act would apply in Ontario. He did not know what the law was in Quebec.

Replying to Mr. Larmouth, Mr. Bicknell said that if a company had a perpetual franchise and had been operating fifteen or twenty years without paying pole rent the municipality had no power to impose a pole rent from time to time except under a special agreement. It could tax the poles, however, at their value, the same as any other property.

Replying to the President, Mr. Bicknell said that in the case of a transmission company's line causing a slight disturbance to a railway company's telegraph line which it paralleled twenty-five feet outside the railway's fence, which disturbance could be easily overcome by slightly strengthening the battery used on the telegraph line, the railway company would probably have to take care of it themselves. The railway company was using its property in a somewhat unusual way and if by a reasonable expenditure it could overcome the difficulty it ought to do so.

The President brought up the question of stolen current, relating the case of a company with a clause in their franchise giving the right to fine any person stealing current $100, that is to collect it without going into court, and a further sum of $4 a day during the continuance of the offence, as well as an amount equal to three times the value of the current used. He asked Mr. Bicknell whether the Canadian Electrical Association could adopt any means of getting that sort of regulation into a Dominion Act relating to electric lighting.

Mr. Bicknell did not think there would be much difficulty about it. Very similar provisions prevailed with regard to gas and water companies. He did not think for instance that there would be any difficulty in obtaining the insertion of such a clause in the charter granted to any electrical company.

Mr. Dion said that some companies were not so fortunate as the one referred to in regard to their charters. He asked Mr. Bicknell whether they could protect themselves by inserting in their individual contracts with consumers, a clause giving them power to collect a certain number of dollars if the customer were detected stealing electricity.

Mr. Bicknell thought this could be done legally.

The President stated that in Montreal he did not know of any case where people discovered in the theft of electricity had refused to pay, when notified by the company. There had been a great many such cases but none of them had ever got into the courts or newspapers. The party always happened to have a friend with a $100 bill.

Mr. Bicknell did not think it would make any real difference to an individual company whether they had a contract wherein the customer had agreed to pay the fine, or whether they had a clause in their charter enabling them to impose it. The provision would be more valuable in a charter, however, inasmuch as it would give the right to collect through a sheriff or bailiff and also the right to imprison the offender if he did not pay. It would also be more valuable in a charter because it would cover the case of theft by a non-user.

Mr. Bicknell replying to Mr. Dion said that he did not think there would be any difficulty in getting a legislature to say that a man who has wires of an electrical company upon his premises, is obliged to see that they are not tampered with, and to make him responsible for a certain penalty. Probably they would even go so far as to say that unless he could prove that no current had been taken he would be guilty of a criminal offence. There should be no difficulty in having the onus placed upon the accused.

Mr. W. Williams, Sarnia, asked whether, in the event of a municipality signing an agreement with the Hydro-Electric Commission to take a certain amount of power their obligations with an existing company would be at an end, so far as the provisions of the Conmee Act were concerned.

Mr. Bicknell replied that they would not be obliged to observe the provisions of the Conmee Act, if they took power from the Hydro-Electric Commission, but if there was a valid contract in existence by which the municipality had agreed to take power from a certain company for a number of years, it was bound to carry out that contract. It was not, however, bound to buy out the electric company as under the Conmee Act. The Hydro Electric Commission had power to expropriate the property of any electrical company and when the property went, the franchise would be of no value. But they must get the consent of the Lieutenant-Governor in Council for that purpose, and they must pay full value. Even after expropriation the company could acquire another property and go on doing business. If a company had an exclusive franchise with a period still to run, the general act with reference to the Hydro-Electric Commission would probably not repeal the special act in favor of the company, by which it obtained its exclusive franchise.

Mr. Robert McKay then read a paper on "Contracts," which together with the extensive discussion following will be published in a future issue of the "Electrical News."

Mr. Dion introduced a short discussion upon the Question Box, which he said had been neglected in several ways both by those who wished to ask questions and those who were competent to answer. He himself had neglected to answer questions partly because he had been out of the city and principally because the questions seemed to come towards the end of the year. Some members who had asked questions requesting immediate answers during the recess had received good answers in the statements from engineers, which if obtained in the regular way would have cost them $50 each.

The President said he had been approached in the last day and a half by four members who asked him questions which should have been asked through the Question Box several months ago. It was quite evident that the members were not availing themselves of the opportunity provided by the Question Box. In the "National" the Question Box had grown to be quite a large book. It was handled on the same lines as that of the C. E. A. and there was no reason why the latter should not be of great value.

At the conclusion of the afternoon session Mr. Dushman gave an exhibition of the use of the electric furnace in melting iron. A photograph of the delegates to the convention was then taken.

On Friday morning the President read a letter from Mr. Thomas A. Edison, expressing his regret at being unable to attend the convention.

The secretary then read the list of officers elected for the ensuing year as follows: W. N. Ryerson, President; R. M. Wilson, First vice-president; P. S. Coate, Second vice-president; T. S. Young, Secretary-Treasurer; Managing Committee, R. G. Black, Toronto; A. A. Dion, Ottawa; B. F. Reesor, Charles B. Hunt, London; J. M. Robertson, Montreal; J. J. Wright, Toronto; W. Williams, Sarnia; H. O. Fisk, Peterboro; J. W. Purcell, Walkerville; R. S. Kelsch, Montreal, and W. A. Pearson, Niagara Falls, Ont.

Papers were then read as follows: "The Grounding of Transformer Secondaries," by W. L. MacFarlane, Cornwall; "The National Electric Code," by H. F. Strickland, Chief Electrical Inspector at Toronto, for the Canadian Fire Underwriters' Association; "The Oscillograph," by W. H. Price, Toronto.

These papers together with the discussion which followed them will be published in a future number of the "Electrical News."

The question of the next place of meeting was left in the hands of the executive.

A vote of thanks was passed to those who had contributed papers and to the authorities of the University of Toronto for the use of the convention building. This concluded the convention and the delegates next proceeded to McConkey's restaurant for luncheon, after which they listened to a lecture by Mr. R. J. Clark of the Toronto Railway Company, which was accompanied by fifty lantern slides, describing some of the most difficult power house work that had ever been done in America, particularly at Sao Paulo, Mexico, Niagara Falls and Winnipeg.

The Entertainment Features.

The entertainment features of the convention were arranged in a manner which was greatly appreciated by all. On the evening of the first day a delightful sail upon the lake in the steamer Chippewa was provided, and a great number of the delegates and their friends attended. The capacious proportions of the steamer provided plenty of room for everybody and the trip was a thoroughly enjoyable one. Messrs. H. M. Bennett and R. Wilson, contributed comic songs. Glionna's orchestra provided dance music.

By courtesy of the management of the various companies arrangements were made for delegates to be welcomed at the various power plants and distributing plants in the city.

The ladies were given a drive around the city on Thursday afternoon and afternoon tea was served for them at the Royal Canadian Yacht Club, Centre Island, the same day.

The event of the convention was the baseball match between manufacturers and operating companies at Hanlan's Point on

Friday afternoon. The game showed the existence of a lot of idle talent which surprised even its possessors in several cases. The result was a victory for the operating companies by a score of 11 to 10.

Following is the tabular score:

OPERATING COMPANIES.

	Runs.
J. G. Glasco, c.f.	1
D. H. McDougall, 2b.	1
A. T. Hicks, s.s.	0
S. Anderson, 3b.	0
P. S. Coate, r.f.	1
W. A. Pearson, 1b.	1
G. Pearson, l.f.	4
Geo. Campbell, p.	3
Total	11

MANUFACTURING COMPANIES.

	Runs.
Fred Rose, 3b.	1
B. F. Selby, r.f.	0
H. A. Moore, 2b.	2
J. A. Shand, s.s.	1
W. A. Bucke, c.f.	2
W. McCaffery, 1b.	1
J. F. S. Madden, l.f.	2
G. H. Rolland, p.	1
Total	10

A professional catcher officiated behind the bat for both teams.

On Thursday evening special cars carried the delegates to Scarboro Beach Park where they were given a good time in the various amusement resorts of the park.

The Toronto Railway Company furnished free transportation for the delegates during their presence in the city, and the Bell Telephone Company provided a service in the convention building for the accomodation of members.

The University of Toronto science buildings were opened for inspection to the members on Thursday afternoon.

The Register published by Allis-Chalmers-Bullock Limited, Montreal, was as usual one of the welcome features of the convention. It was issued four times during the convention and proved itself most useful. By the system of numbered buttons, as indexed in The Register, every member was able to identify every other member present. The Register also contained a copy of the programme and a number of useful announcements telling members what to do and where to go, so as to get the most benefit out of the convention.

Mr. H. F. Strickland, Chief Electrical Inspector at Toronto, of the Canadian Fire Underwriters, writes to "The Electrical News" as follows:

During the convention of the Canadian Electrical Association, owing to lack of time I was unable to read my paper on the Code, but wish to explain one point which was brought up by Mr. Kelsch. As I have had several inquiries regarding this point since the convention, I think it advisable that parties interested should hear what the intention was in connection with the clause referred to on page 9 of my paper under the heading "Induction Motors," which reads as follows:

"Passing on from transformers to induction motors, I think it is worth while mentioning my belief that the most satisfactory method of installing a starting and controlling apparatus in connection therewith is to instal them entirely in a fire proof cabinet, that is to say, that the auto starter, fuses and switch should be in a fire proof cabinet, etc."

Mr. Kelsch took some exception to this point, stating that he had never heard of any trouble from an auto starter. I quite agree with Mr. Kelsch on this point, but the intention is not merely to enclose the auto starter, but in both alternating and direct current it is decidedly advantageous to have all controlling apparatus, that is to say, fuses, auto starters, starting box and knife switches contained in a neat fire-proof cabinet. During the course of our inspections we come across many indications which warrant this requirement, and will positively require such in certain places which might not be necessary where this apparatus is located in fireproof buildings away from inflammable material. I merely mention this in order that the point will not be misunderstood.

The Association's New President.

Mr. W. N. Ryerson, the president-elect, is a native of New York City, having been borne there in 1874. He received his education as an engineer in the School of Mines of the Columbia University, graduating with the degree of Electrical Engineer in 1896. Mr. Ryerson was connected for short periods with the Sprague Electric Elevator Company; the Western Electric Company; and was then appointed assistant to the chief engineer of the Waldorf-Astoria Hotel, during the erection of the isolated plant. He was then for three years employed by the Metropolitan Street Railway Company, New York, in the construction and operating department and left that company to accept the position of chief operator to the Manhattan Railway Company New York City and was for three years superintendent of the sub-stations for this company and later for the Interborough Rapid Transit Company, having the entire supervision of all of the designing, the construction and operating of the sixteen sub-stations throughout New York City for the operation of both the Manhattan elevated system and the New York subway. Since April 1st, 1905, he has held the position of superintendent of the Ontario Power Company of Niagara Falls, in charge of construction, operating and local business management. Mr. Ryerson is an associate member of the American Institute of Electrical Engineers; a member of the American Society of Mechanical Engineers, and a member of the Canadian Society of Civil Engineers.

Sparks.

The by-law to raise $18,000 for a municipal electric light plant at Listowel, Ont., has been defeated.

The British Columbia Telephone Company are preparing to build a telephone system in South Vancouver. The company also plan the construction of 52 miles of long distance line this summer, with exchanges at all necessary points.

Plans are being prepared by Charles Brandeis, consulting engineer, Montreal, for a new steam plant of 2,000 h.p. capacity for the Saraguay Electric & Water Company and tenders will probably be called at an early date.

It is now definitely stated that the Bell Telephone Company will erect a new five storey exchange on the Carrol property at Bay and Adelaide streets, Toronto. The estimated cost of the proposed building is $250,000.

The Portage la Prairie town counicl have engaged Mr. Skinner, an electric expert of Winnipeg, to make a report on the best method of lighting the city, whether by purchasing the existing plant, installing a new one or by contract.

The Central Light & Power Company, Wolseley, Sask., will increase the capacity of their plant in the near future. It is proposed to install a 150 h.p. gas engine and suction gas producer and a 90 kw. generator. Lee Boyer is manager.

George Harper, chief engineer of the International Heating & Lighting Company, Cleveland, Ohio, has a franchise for installing a gas plant at Brandon, Man. The work of laying the mains will be started at once. About fifteen miles of mains will be laid in all.

The Montreal city council have decided to accept the offer of the Robert Company, to supply electricity in the city for lamps and motors. The company will develop power on the Beauharnois Canal. E. A. Robert, E. B. Greenshields and G. G. Foster, are interested in the enterprise.

The Vancouver Island Eastern Railway Company, organized last year to build an electric railway from Esquimalt Harbor, Vancouver Island, north to Seymour's Narrows, and from Bute Inlet or Frederick Pass to Edmonton, have applied for a charter. The directors include T. W. Patterson and H. A. Munn, Victoria, B.C., Jas. Smith, Edmonton, Alta., and M. J. Harvey, Toronto.

The following tenders have been awarded at Winnipeg by the Department of Telephones and Telegraphs: Construction of line from Winnipeg to St. Anne, 37 miles, D. R. McLeod, $55 a mile for 32 foot poles and $59 for 36 foot poles; Virden-St. Clair line, 29 miles, W. G. Wyatt, $65 a mile; Selkirk-Gimli line, 42 miles, Minnedosa-Binscarth line, 103 miles, Minto-Belmont line, 60 miles, and Brandon-Rounthwaite line, Stone & Green, $87 a mile. The Northern Electric & Manufacturing Company, Montreal, and Canadian Independent Company, Toronto, were awarded the contracts for common battery and telephone sets. For the supply of lead cable the Wire & Cable Company, Montreal, were the successful tenderers, at about $40,000. The Whitecross Company, Limited, and the British Insulated & Helsby Company, Limited, share a contract for 150 tons B. B. No. 12 galvanized iron wire at three cents a pound, f.o.b. Winnipeg.

Electrical Franchises, their Legal Status and Basis of Valuation

Paper read before the C.E.A. Convention, by James Bicknell, Toronto.

A franchise is a privilege of a public nature conferred by or under legislative authority.

By electrical franchises, for the purposes of this paper, must be understood the rights and privileges which are conferred upon electrical companies with respect to the use of highways for the purposes of their businesses.

It is not proposed to discuss the powers which are conferred upon electrical companies by their charters except in so far as such charters confer the right to use highways. Electrical companies are in almost every case compelled to use public highways for the transaction of their business. It is true that in some instances small electric railways are operated wholly upon private grounds, and there are also many isolated electric light plants for lighting single manufactories or large business houses, and there are also instances of telephone and telegraph lines on private premises, but by far the larger proportion of all companies doing any of the above businesses require a right of way over public highways. This right consists of a right to set their poles and string their wires, and maintain the same on, over and under the public highways.

The power to grant the right to construct and maintain upon, along, over and under a public highway such structures or conduits as are necessary for the operation of telegraph, telephone, electric light and electric railway plants, resides, in the first instance, in the legislative body having jurisdiction over the subject mater. In the United States the right resides, in the first instance, in the State Legislatures. In Canada the legislative power is divided. The Parliament of Canada, which may be conveniently caled "The Federal Parliament," has under the constitution the exclusive jurisdiction over railways, telegraphs and other works and undertakings connecting one province with any other or others of the provinces, or extending beyond the limits of any province and over such works as, although wholly situated within one province, are declared by the Parliament of Canada to be for the general advantage of Canada or for the advantage of two or more provinces. On the other hand, each province has exclusive jurisdiction over municipal institutions, property and civil rights within its borders, and generally all matters of a merely local or private nature.

For practical purposes, the Dominion Parliament may be said to have the jurisdiction over all telegraph lines whether constructed by telegraph companies or by railway companies, and over the trunk or long distance telephone lines.

There are some electric railways situate wholly within the province of Ontario which have been declared by parliament to be for the general advantage of Canada, and are therefore free from the control of provincial legislatures. There are others which extend beyond the limits of the province, and are therefore properly the subject of Dominion jurisdiction.

The principal telephone company, the Bell Telephone Company of Canada, is incorporated by an act of the Dominion Parliament passed in 1880, and all its works have been declared to be for the general advantage of Canada.

It follows that the Bell Telephone Company has acquired from the Legislature of Canada all that is necessary to enable it to carry on its business in other provinces of the Dominion, and that no provincial legislature is competent to interfere with its several operations as authorized by the Canadian Parliament. Under its Act of Incorporation that company is authorized to acquire any lines for the transmission of telephone messages in Canada or elsewhere, and to construct and maintain its lines along or across or under any public highways, streets, bridges, water courses, or other such places, or across or under any navigable waters either wholly in Canada or dividing Canada from any other country.

It has been decided by the highest court of the Empire that the undertaking of the Bell Telephone Company is one single undertaking, and though for certain purposes its business may be local, it is one entire business, and for the purposes thereof it has the right to exercise all the powers conferred by the Act.

It has been contended upon the part of municipalities that the streets and highways are the property and within the control of the Provincial Legislatures, and that therefore the Dominion Parliament should not interfere therewith, but this contention has been distinctly negatived, and it is clearly settled that the Dominion Parliament has the right to confer upon any company properly incorporated by that parliament powers over the streets and highways of any municipality in Canada.

There are not many electrical franchises granted by parliament direct. The case of the Bell Telephone Company is an instance of such a franchise granted to a particular company.

Franchise Provisions.

The Railway Act of Canada contains provisions relating to the construction of telegraph and telephone lines by railway companies, and also contains provisions authorizing any company empowered by parliament to construct, operate and maintain, lines of telegraph or telephone, or for the conveyance of light, heat, power or electricity, with the consent of the municipal council or other authority having jurisdiction over highways, to construct its lines, subject to certain conditions, upon the highway so authorized, and the Act also contains provisions conferring upon the Board of Railway Commissioners for Canada the authority to confer the right upon such companies to exercise such powers, notwithstanding the refusal of the municipality to grant the franchise, provided that the franchise is not exercised for the purpose of selling or distributing light, heat, power or electricity, in cities, towns or villages, without the company having first obtained consent therefor by a by law of the municipality.

All telegraph companies incorporated by the Parliament of Canada have the right under the General Telegraph Act, R. S. C. Chapter 126, to construct their lines of telegraph along and upon any of the public roads and highways or across or under any of the navigable waters in Canada without the consent of the municipalities, subject to the condition that the lines shall be so constructed as not to incommode the public use of such roads or highways, or to impede free access to any house or other building erected in the vicinity of the same, or injuriously to interrupt navigation.

The charters of electric railway companies generally provide that no such company shall use any part of a highway except with the consent of the municipality in which such highway is situate. Such was the provision of the Street Railway Act under which the earlier street railway companies were incorporated. Such was also the provision of the Electric Railway Act of 1895, and such is now the provision of the Ontario Railway Act respecting street railways.

The original Street Railway Act was intended to apply to street railways constructed for the purpose of one municipality or two or more adjoining municipalities.

Municipalities were prohibited from granting to street railways a franchise for more than twenty years. The Act provided that at the expiration of the twenty year franchise, or at the expiration of any fifth year thereafter, any municipality through which a street railway ran might assume the ownership of the railway. This meant the entire railway. If the railway extended into more than one municipality it was provided that the municipality having the larger mileage should have the first right, but where the municipalities were of a different character, the right of purchase should be in the following order of preference: First, a city; second, a town; third, a village;fourth, a township.

Under the Act of 1906 a street railway means a railway constructed or operated along a highway under or by virtue of an agreement with or a by-law of a city or town, and it includes all portions of such railway within such city or town and for one and a half miles beyond the limits thereof. Franchises to such street railways must not extend longer than twenty five years. Such street railways may be acquired at the expiration of the twenty five year period, or at the expiration of any fifth year thereafter, by the city or town municipality, unless the municipal councils agree otherwise between themselves.

Electric railways as distinguished from street railways were formerly governed by the Electric Railway Act of 1895. No limitation was by that Act imposed upon the duration of franchises granted to such railways.

The Act of 1906 now provides that no municipal council shall grant to any railway company operating by electricity any privilege to operate along a highway for a longer period than twenty five years. At the expiration of twenty five years any municipality through which an electric railway runs may, with the written consent of the Ontario Railway and Municipal Board, acquire the ownership of that portion of every electric railway operating within its limits.

To prevent companies having franchises from municipalities escaping from the operation of the laws of Ontario, the Ontario Legislature of 1907 passed an Act providing that any public

utility (which words comprise waterworks, gasworks, electric heat, light and power works, telegraph and telephone lines, railways however operated, street railways and works for the transmission of gas, oil, and water or electrical power or energy, or any similar works supplying the general public with necessaries or conveniences) is declared to be a work for the general advantage of Canada, and if absorbed by or amalgamated with or controlled or operated by any other company or corporation whose undertaking shall be so declared, or which is not subject to the legislative control of Ontario, the Lieutenant Governor may declare that the franchises of such public utility shall be forfeited and thereupon every municipal by law granting such franchise becomes void, subject, however, to the rights of the holders of debentures issued by municipal corporations for payment of any bonus, and subject also to the claims of any bona fide creditor of such public utility. It was also provided that thereafter no municipal corporation should without the approval of the Lieutenant Governor in council grant franchises to companies not subject to provincial control.

It follows from what has been said that franchises may be granted:

(a). By the Federal Parliament to such companies as fall within its jurisdiction, e. g., railway, telegraph, long distance telephone and similar companies, as well as all companies declared by parliament to be for the general advantage of Canada, or any two or more provinces thereof.

(b). By provincial legislatures with regard to all companies of a local or private nature.

(c). With legislative authority by any municipal corporation subject to the restriction that no municipal corporation may grant a franchise to a Dominion company without first obtaining the approval of the Lieutenant Governor in council.

Conflict of Franchises.

Difficult questions frequently arise with regard to the adjustment of rights between electrical companies authorized to use the same highway. For instance, a conflict may arise between a telegraph company, and (a) an electric light company, (b) an electric railway, (c) a telephone company. A conflict may also arise between the other classes of companies.

In such cases it is necessary to examine into the charters, franchises and powers of each company, and to ascertain therefrom how far if at all a prior exclusive right has been granted to the company first occupying the ground. For instance, the mere right of a telephone company to string poles and wires does not give it the right to exclude the use of the streets by electric railways or for other purposes requiring the use of electricity whenever the use of this agent interferes with the use of the telephone. Neither priority of grant nor priority of occupation will necessarily avail either party.

If the telephone company can by the adoption of a metallic circuit or similar means avoid injury, it will have no right to prevent another company from using in a reasonable and proper way the highways over which its franchise extends.

Where a telegraph company had strung its wires along a street, and was carrying on a telegraphing business, an electric light company was enjoined from stringing its wires at such distances of the wires of the telegraph company as to create a danger.

On the other hand where the electric light company had already strung its wires and was operating them, the telegraph company could not compel it to remove them so as to allow it to occupy the street under a franchise granted by parliament. In the same way, an electric light company will be forbidden to place its wires so close to telephone wires as to impair the telephone service.

Monopolies are not favored by the law, and except to a telephone company for five year periods, the granting of monopolies by municipal corporations is forbidden. An exclusive franchise to be valid must, therefore, be confirmed by legislation.

Even franchises granting rights to construct electric railways upon a highway will be so construed as not to prevent another railway company obtaining a franchise for constructing its railway upon the same highway unless there are express words making the earlier franchise exclusive.

No municipality has the right to confer upon any electrical company the right to string its wires over private lands. The stringing of such wires over private lands is technically a trespass which may be restrained by injunction. Modern conditions however, are such that private owners for the convenience of themselves and their neighbors seldom object to telephone wires passing over their property. By a recent Ontario Statute it is provided that no telegraph or telephone company shall by lapse of time acquire a title to maintain such wires. There has been no similar prohibition enacted against other electrical companies. All companies should, however, be careful to see that in all cases where it is necessary to use private lands for stringing their wires they acquire a grant of such right either in perpetuity or for some lesser period.

A franchise is not property which can be taken in execution and sold by a sheriff for debt. If the franchise is by the terms thereof or by the statutes applicable thereto transferable from the company to which it is granted to another company or individuals, it may be mortgaged or transferred as security for debts properly incurred.

A franchise may be altered by parliament or by the legislature. Neither parliament nor the legislature in revoking or altering a franchise need grant compensation. It is, however, one of the principles of the British constitution that parliament is presumed never to act unjustly, and any Act impairing the rights of a company under a franchise will therefore be strictly construed by the courts, and if possible such construction will be given to it as will prevent any injustice being done. Except the right to revoke or alter a franchise is conferred in express terms either by legislation or by the terms of the franchise itself, no municipality has any power by by-law or otherwise to impair the rights conferred by the grant of the franchise, and any by-law or resolution purporting to do so would on application be quashed.

Franchises may by proper legislative authority be taxed. No tax upon a franchise as such has so far been imposed in Ontario. A franchise is neither real nor personal property, and is therefore not the subject of municipal taxation.

Expropriation.

Powers of expropriation of franchises are frequently conferred. The Telegraph Act enables the Crown to expropriate the property of telegraph companies. The Hydro-Electric Act enables the Hydro-Electric Power Commission to expropriate the properties of electrical companies with the authority of the Lieutenant Governor in council. Upon any acquisition by expropriation properly so called the full value of the property acquired is payable, and the amount must be setled by arbitration. The acquisition of the properties of electrical companies by municipalities at the expiration of their franchises, or the acquisition of such properties with a view to municipal ownership under the Conmee Act is not properly speaking expropriation.

Section 566 of the Municipal Act of Ontario, commonly known as the "Conmee Act," provides that a municipality shall not embark in the business of supplying electric light until after a by-law has been passed fixing a price to offer for the work of an existing company, or until after thirty days have been elapsed after notice of such price has been communicated to the company without the company having accepted the same, or without the company having agreed to arbitration. This provision applies only to an electric light company which has supplied electric light for street lighting.

Upon a valuation under the Conmee Act the following factors determine the value:

1. What the works would cost if then constructed.
2. The condition of the works, the deterioration thereof, and whether they are wholly or in part obsolete.
3. The value of the works to the municipality and the extent to which the municipality can make use of the same, and the value for commercial and such other purposes as the company could use them for.
4. The cost of procuring more valuable or modern improvements or appliances, and the cost of acquiring the right to use and of adopting such improvements.
5. No allowance is to be made with respect to prospective profits or franchise.

Notwithstanding the provisions of the Conmee Act, the legislature in constituting the Hydro Electric Power Commission in 1906 authorized municipalities to purchase from the Hydro-Electric Commission power or energy for the uses of the corporation and the inhabitants thereof for lighting, heating and power purposes, and it was distinctly provided that a municipal corporation entering into a contract with the Commission should not be required to purchase existing plants. The Act is not intended to authorize ruinous competition with electrical companies. On the contrary, the policy of the Act is to compel municipal corporations not only to pay the cost of the power acquired from the Commission, but to provide a sinking fund for the payment of the capital invested by the Commission within thirty years. Power is given to any municipal corporation, company or person, to complain to the Commission if any municipal corporation is making use of the power conferred upon it for the purpose of granting bonuses by supplying light, power, or heat below cost to manufacturers or others.

If these provisions are carried out in good faith by the various municipalities, it is possible that no municipality will be able to afford to supply light, heat or power at as low a rate as an electrical company efficiently and economically managed.

In the exercise of its statuory powers over highways an electrical company is authorized to create what would otherwise be a nuisance; e. g., an electric railway company is allowed to obstruct a highway with its rails, poles and wires; telephone, telegraph and electric light companies are allowed also to obstruct and disfigure highways; but, save so far as reasonably necessary, no such company is authorized to create a nuisance. It is, in other words, bound not to create a nuisance wherever in reason its powers may be so exercised. An electric light company has therefore been restrained from carrying on operations causing so much vibration to a house upon adjoining land as to render such house uninhabitable. Street railway companies have been restrained from maintaining stables adjoining dwelling houses in such a manner that the noise from the horses. prevented the convenient enjoyment of the houses.

Basis of Valuation of Franchises.

The law does not prescribe any rule placing a valuation upon an electrical franchise. The existence of the franchise frequently has an important bearing upon the value to be placed upon the other property of the company. The valuation to be placed upon such property depends upon the consideration of the situation at the time when the value has to be fixed. There are three possible situations which have to be considered, namely:

1. If the franchise is at an end and the municipality is not empowered to acquire the property of the company, the value of the property of the company is no higher than the value of the bare materials. The reason for this is that no one has the right to retain or use them in the situation in which they are found.
2. If the franchise has expired but the municipality or other persons may either possess or be in a position to acquire a new franchise, the value is such sum as it would cost to construct and establish the same with a deduction of a proper sum in respect of depreciation.
3. If the franchise has not expired, and the right to use the property is either to continue in perpetuity, or for a time limited, this right is inherent in the right of property, and in such case the valuation has to be made upon the basis of capitalizing the annual sum which a tenant would be called upon to pay as a rental therefor. In other words, the net earnings of the company and its prospects have to be taken into consideration, and a fair capitalized value allowed therefor.

No sum is therefore allowed as the value of a franchise which has expired.

Applying these principles to some concrete cases by way of illustration, the following results are obtained:

(a). If the property of a telegraph company should be expropriated by His Majesty, the full value of the property based upon the net earnings should be allowed.

(b). If the property of the Bell Telephone Company should be expropriated, it would be entitled to an allowance for its franchise based upon its net earnings.

(c). If the property of an electric railway company having an unexpired franchise either in perpetuity or for a limited time should be expropriated, an allowance would have to be made for its franchise based upon its net earnings and upon the period which the franchise had to run.

(d). If the property of a street railway company were acquired by a municipality at the expiration of its twenty or twenty-five year franchise, no allowance would be made for franchise.

(e). If the property of an electric light company were acquired pursuant to the provisions of the Conmee Act no allowance would be made for franchise.

(f). If the property of an electric light or power company were acquired by the Hydro-Electric Commission, allowance would have to be made for franchise, but the effect of municipal competition under the Act would have to be taken into consideration.

(g). If the part of an electric railway within a particular municipality were assumed by the municipality at the expiration of the twenty-five year franchise, the valuation would be upon the basis of the cost of construction and establishment of the railway with proper deduction for depreciation.

The Moose Jaw, Sask., town council have awarded the contract for the new generating unit to the Canadian General Electric Company, at $36,000.

Sparks.

The electric light plant at Sherbrooke, Que., has recently been taken over by the corporation.

The City of Sherbrooke, Sherbrooke, P. Q., have retained Mr. R. S. Kelsch, Consulting Engineer, Montreal, in connection with the additions to their power plant consisting of new 500 kw. generator, switchboards, etc.

Mr. S. T. Faram, Toronto representative of the Benjamin Electric Manufacturing Company of Chicago, was married on June 3rd to Miss Augusta Ogilvie. The bride and groom spent a couple of weeks visiting Mr. Faram's old home.

The annual convention of the Association of Railway Telegraph Superintendents was held at Montreal during the last week of June. Mr. W. J. Camp, electrical engineer of the Canadian Pacific Telegraphs, Montreal, was elected president.

An electrical engineer is wanted by the city of Toronto to prepare plans and specifications for a distributing plant and superintend the construction thereof. Applications will be received at the City Hall by Joseph Oliver, Mayor, until July 13.

In connection with changes which the Consolidated Elevator Company of Fort William propose making in their electric installation, they have consulted Mr. C. W. Stokes, of Harpell-Stokes, Limited. Mr. Stokes recently spent a week in Fort William looking into the situation.

The Central Heat, Light & Power Company have placed, through Messrs. Laurie & Lamb, consulting engineers, Montreal, their order for a fourth Beliss engine for their power house on St. Peter street, Montreal. This engine will be of 130 h.p. with 25 per cent. overload capacity.

Southam, Limited, Montreal, have their new establishment completely equipped with individual motor drive. The Crocker-Wheeler motors were installed and the complete plant was purchased and installed under the supervision of R. S. Kelsch, Consulting Engineer, Montreal.

The Board of Control, Winnipeg, Man., have accepted the tender of J. J. Gartshore & Company for the supply of 850 tons of steel rail for use on the Pointe du Bois tramway. The contract for supplying spike attachments, etc., was awarded to the Montreal Roller Mills Company.

The Canada Tag and Label Company, Montreal, have their new stablishment completely equiped with individual motor drive. The Crocker-Wheeler motors were installed and the complete plant was purchased and installed under the supervision of R. S. Kelsch, Consulting Engineer, Montreal.

The City of Montreal have ordered one of the well-known Belliss engines of triple expansion type, and of 750 to 800 h.p. for the low level pumping station. The engine will be directly connected to a Worthington centrifugal pump. The contract for the installation was taken by the John McDougall Caledonian Iron Works, Limited, Montreal.

Mr. J. C. Royce, engineer, Toronto, has returned from London, Ont., where he has been inspecting the Gould storage battery plant, recently installed by the London Street Railway Company. While in London Mr. Royce also made an examination of the McClary manufacturing Company's 200 h.p. gas power plant which he recently installed for them, and found it giving good satisfaction.

The Montreal & Southern Counties (Electric) Railway Company have opened offices at 605 and 656 Canadian Express building, McGill street, Montreal. W. B. Powell is manager of the company, and J. A. Burnett superintendent and electrical engineer. Work is now proceeding on the Montreal-St. Lambert section of this road, and entry into the city of Montreal has been arranged for.

Laurie & Lamb, Board of Trade Building, Montreal, Canadian agents for Crossley's gas engines and suction gas plants, are tell of their good points, on a large illustrated postcard. A picture is shown of the suction gas plant and engine, which they claim gives 18 h.p. 10 hours a day for a year at a total fuel cost of $135, or $7.50 per horse-power. The space occupied by the plant and engine is 19 feet by 12 feet, but larger or smaller sizes are made to meet requirements.

The re-construction of the Quebec Railway Light and Power Company's property is nearing completion. The transmission line has been changed from 5,000 to 25,000 volts. A large storage battery has been installed which will be of great benefit during the coming Tercentinary. The new substation is completed, and the apparatus placed under operation. The transformers, switchboards, lightning arresters, etc., were furnished by the Canadian Westinghouse Company, Limited. The re-designing of plant and installation of apparatus is being done by R. S. Kelsch, Consulting Engineer, Montreal.

Power Rates and Factors which Influence them

Paper read before C.E.A. Convention by W. N. Ryerson, Niagara Falls, Ont.

In the study of power rates it must be evident that they will necessarily vary as the cost of supplying the various classes of load to the power company varies. All legitimate business concerns are entitled to a reasonable return on the investment necessary to carry on their affairs, and the legal right to vary their prices in the same locality, in accordance with the cost of the particular service, has been passed on several times by courts throughout the United States, and in the absence of legislation fixing rates or delegating this power to commissions or other bodies, it has been held that electric light and power companies, as well as gas companies, may require and collect minimum charges, even though the price of the power or gas consumed has not amounted to the minimum asked. The right has also been recognized to charge one customer one rate, who uses his power at other than peak periods, while another customer, under otherwise similar conditions, but who cannot or will not shut down or reduce the amount of his power during peaks, is charged more.

The factors which have the greatest influence upon the rates to be charged are: First, the distance of the customer from the source of supply; second, the amount of power the customer desires to use; third, the character of the customer's load—whether steady or intermittent, and, if the latter, the time, frequency and duration of peaks, or, in other words, the load factor; fourth, the average power factor; and, fifth, whether the load will be balanced or unbalanced.

The first two factors are well understood and require little comment. It is evident that increased investment in circuits to reach the customer, as well as the size of conductor necessary to carry his load, must be taken into account in fixing the rates to be charged. It is also plain that, other things being equal, 10,000 h.p. can be sold at a lower price per h.p. than 500 h.p. The question of load factor, however, is by far the most important element entering into the cost of supplying power and at the same time is usually the most difficult to explain to a non technical man. More will be said about load factor further on in this paper. Power factor also is very important, but this may be taken account of very easily. One method is to allow the customer a power factor as low as, say, 90 per cent., but should it go below this figure, require from him a payment based upon 90 per cent. of the kilovolt amperes—periodical tests to be used for purposes of determination.

Unbalancing is not usually so serious, except in the case of large single phase electrolytic or arc furnaces, and in these cases it is well to allow say 10 per cent. of unbalancing. In other words, should the difference between any two phases be greater than 10 per cent. of the lesser, then the power to be charged for shall be computed on the assumption that the current, and therefore the power taken from each side of the phase is equal to the greatest amount actually taken from any one place.

The following are the principal methods at present used in charging for power: The flat rate; the meter rate with or without a service charge. In addition to these there is a method not largely used, but which has a great deal to commend it, which is termed the "Sliding Scale." The fourth method, with only limited application, is what has been termed "Second Class Power."

The Flat Rate.

This method is undoubtedly in most cases the best for the power company, as under it should the customer's load factor be comparatively low, the installed capacity of the power plant may be oversold. Certain types of load lend themselves naturally to this method of charging, such, for instance, as electrolytic and other furnace loads running twenty-four hours per day and usually at a very steady rate. In this form of contract it is usual to require the customer to contract for a minimum amount of firm power for which he is obliged to pay whether he uses it or not. It is essential to meter the power by means of a curve drawing wattmeter, which will show every variation and determine whether the agreed minimum firm power has been exceeded, at what times, and by what amounts. The usual method of determining the bill is by averaging the daily peaks throughout the period for which charge is made, these peaks being of any pre-determined length. Another method sometimes used is to equip the circuit with an automatic overload circuit breaker, so adjusted as to open the circuit whenever the agreed amount of power is exceeded. In some forms of contract it is provided that the customer's load shall increase by regular increments at stated times, and, that furthermore, should his maximum peak exceed his firm minimum power by a certain percentage, varying from 10 per cent. to 40 per cent., depending upon the amount of firm power, his minimum firm power will thereby automatically increase to the point of the maximum swing, and that this amount shall thereafter be taken and paid for. The usual objection to the Flat Rate method of charging is that it has a tendency to make the customer wasteful of his power. Another objection is that the curve drawing wattmeter, which is necessary for accurate determination under this form of contract, is not as simple and reliable as the integrating wattmeter, and costs considerably more.

The Meter Rate.

This is the most universally used and best understood method of charging for power. By it book-keeping is simplified, and the meters required are more reliable as well as cheaper, but, as generally employed, it has the distinct disadvantage of not distinguishing between a customer having a high load factor and one having a low load factor, and is, therefore, not equitable to both parties unless the rates are carefully chosen or combined with some method of service charge, or a penalty for excessive peaks, etc. So well is this recognized that the straight meter is rarely used at the present time, except in very small units, and it is more usually combined with a service charge (guaranteed minimum payments per horse-power installed), or by differential rates, the higher rates being charged during peak hours. This latter method leads to complication in the meters and is undesirable. Another method proposed for selling power under the Meter Rate is a scale of reduction in prices per kilowatt hour as the number of kilowatt hours during the period of charge increases and as the minimum payments, guaranteed by the prospective customer, also increase. This method may be so arranged as to take account of load factor, by guaranteeing a minimum payment per horse-power of connected load for the period of charge; the larger the guarantee the lower the price per kilowatt hour becomes. Maximum demand meters have been used to some extent, but they have not been developed to such a point as to be considered commercial. The usual method with these maximum demand meters is to make a certain charge per kilowatt of maximum demand plus a small charge per kilowatt hour of consumption.

Various methods of determining service charges have been used, but the usual one is to base the charge upon the installed capacity of apparatus, varying the amount with the various types of installations and based upon previous experience. It is difficult to convince a customer of the justice of such a charge and the method of arriving at it. It is at times necessary to limit the hours run by a factory or other user during the winter months, in order that they shall not be run during times of peak load on the station. This point will be taken up later, in connection with "Second Class Power."

The Sliding Scale.

This form of contract is based upon the customer's load factor solely, but the power is sold on a maximum demand basis, the rate per horse-power per year varying between fixed limits in each particular case corresponding to the load factor. The load factor is based on a twenty-four hour day and is taken over the period for which charge is made (usually one month.) The average demand is the total kilowatt hours, or horse power hours consumed during the month, divided by the number of hours in the month. The maximum demand for one day is the mamimum peak lasting for a period of one minute or more, and as shown by a curve drawing wattmeter. The maximum demand for one month is taken as the average of the daily one minute peaks during the month.

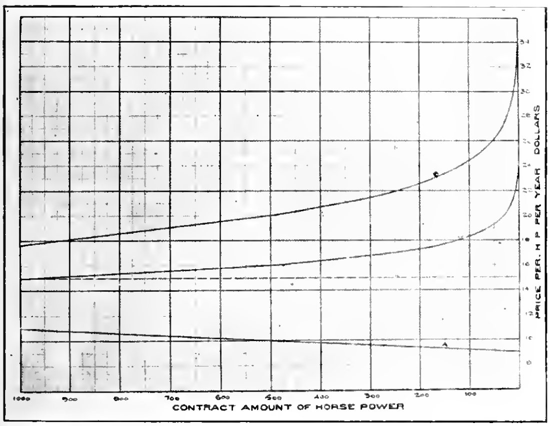
A series of curves is drawn up for each particular locality based on a flat rate curve, "C," which, in this particular case reaches $15 per horse power per year at 1,000 horse-power. This Flate Rate curve is arrived at by adding together all the various factors entering into the cost of delivering power to the locality in question, taking into account the decrease in cost per horse-power per year, as the amount consumed increases, and assuming that power sold on the Flat Rate basis would have a load factor of approximately 100 per cent. Should the customer's load factor be low the power company may oversell its plant capacity as previously mentioned, to an extent which can only be arrived at by experience, but, in general, it will increase as

the number of comparatively small installations connected to it increases.

The maximum rate curve "B" and the minimum rate curve "A" are arrived at from experience and by the "law of probability," the one being above and the other below the $15 base curve.

Thus assuming, referring to these curves, that the customer wishes to contract for 500 h.p. His flat rate will be $16 per horse-power per year, his minimum rate $10, and his maximum rate $20. If during any one month his maximum demand (or the average of his daily one-minute peaks) has been 510 h.p. and his average demand 204 h.p., then his load factor for the month would be 204 divided by 510 = .04, and the rate per h.p. per year would be $10 + $10 x .4 = $14, and the monthly bill would be 510 x $14 ÷ $595—or, in other words, the rate per horse-power per year is determined by adding to the minimum rate (or the rate at zero load factor) the load factor times the difference between the minimum and maximum rates. Supposing the month in question to have been one of 31 days, the average demand would correspond to a consumption of 151,776 horse-power hours, which would cost him 0.39 cents per horse-power hour or 0.52 cents per kilowatt hour.

Now, suppose that in another month the maximum demand remained 510 h.p. as before, while the average demand increased to 408 horse-power, thus making his load factor .8 instead of .4, the rate per hourse-power per year would then be $18 and the



monthly bill $765. This is at the rate of 0.25 cents per horse-power hour, or 0.34 cents per kilowatt hour, thus showing conclusively that, under this method of charge, there is a strong inducement for the customer to increase his load factor.

Certain manufacturing processes lend themselves readily to intermittent service, although having a high load factor while in operation. In this class are certain electrolytic and smelting processes. One method of handling this business is to contract with them for certain minimum amount of power to be used twenty four hours per day (so-called First Class Power), and then during certain hours when the remainder of the power station load is light allow them to take a much larger amount, paying for both kinds of power on the Flat Rate basis. This latter excess has been called "Second Class Power," and it is evident that a very low rate per horse-power hour or per kilowatt hour can be made for it, where the conditions are otherwise favorable.

Although heretofore there has existed a wide diversity of opinion among the various companies in regard to the manner of charging for power, it is the writer's opinion that this is fast disappearing and that power customers are becoming divided naturally into certain definite classes, based upon experience with similar cases, and for each of which a definite method of charging can be arranged so that the income to the central station will be as nearly as possible proportional to the actual cost of supplying them with power. The writer holds no brief for any particular method of charging, but prefers what has been described as the "Sliding Scale" contract, especially where power is derived from waterfalls, on the ground that it offers greater inducements to raising the load factor.

Fortunately there has, so far, been no legislation in the Dominion of Canada regarding rates for electric light or power, and it would seem that the various members of the Canadian Electrical Association should be on the alert to forestall and prevent such legislation, by so adjusting their rates of charging that no inequality or unfairness can be claimed. Such a course will in a large measure forestall any legislation, which is almost certain to be detrimental to the power companies.

Municipal Ownership Folly.

Municipal ownership in Canada, especially in Ontario and Western Canada, has assumed alarming proportions. In using the word "alarming" it is from a tax payer's and not from a central station man's point of view, for, if we are to be placed in the position of our Australian friends where municipal ownership has been such a great success (?) tax payers surely will have cause for alarm.

For several years the electric light and gas companies in the United States have had to combat the municipal ownership craze, which, at one time, promised to give cause for alarm. However, the tide has turned over there, and the figures of late show that the relatively small growth of the municipal plant is sufficient and good ground for the optimistic feeling expressed by those interested, as we are, in central station lighting and distributing work.

Statistics for the half year ending September last show the value of municipal plants constructed to have been $659,000, while the private plants constructed during the same period cost over $18,000,000.

While it appears that Canada must pass through a wave of municipal ownership folly, it is hoped that we will not have to contend with this burden for any such length of time as our friends across the water and across the line.

In connection with the wonders of municipal ownership, it is interesting to find that this matter has received the attention of the Senate, and that all public men are not of the same mind on municipal ownership, but that there are some broad minded and deep thinking men who view this matter in a different light, and who have already voiced their sentiments in a manner that must have considerable effect.

Perhaps the most interesting words uttered by a public man on this point during the past several years, will be found in the speech of the Hon. Senator Belcourt made before the Senate in Ottawa on Wednesday, March 25th of this year and a few quotations from this speech may not be out of place.

Senator Belcourt points out that, "The function of Government is to protect society against foreign aggression,—to defend, by wise administration of justice, each of its members against every unjust enterprise, and finally to provide the community with certain indispensable establishments, which do not appear to the Government to be susceptible to individual creation or maintenance."

We surely have an abundance of proof to show that the electric light and power industry does not come under this heading.

The word "alarming" used in the foregoing remarks will not be considered out of place or inadvisedly used if we refer again to some figures given in the Hon. Senator's speech, where in it is shown that "with 1 11 of the population of the United Kingdom, Australia's debt per head is more than three times as much as that of the United Kingdom. Australia has 1 20 of the population of the United States, and its debt per head is twenty four times larger than that of the United States. Canada with 1-5 more in population has a debt per head which is seven times smaller than that of Australia."

The Hon. Senator's speech contains an abundance of food for reflection for the municipal ownership advocates, and will be found equally interesting to those engaged in electric light and power work. It is to be hoped that his remarks on this subject may be taken to indicate that the tide is turning against the municipal ownership folly.

Tenders will shortly be taken for the installation of heating apparatus, electric elevators and laundry machinery in the new hospital building at Calgary, Alta.

An advice from Vancouver states that plans have been prepared by E. K. Rogers for the erection of a $10,000 power plant in connection with the Hidden Creek mines at Goose Bay, Observatory Inlet. The plant will be installed this summer.

The Provincial Government of British Columbia has approved the plans of the Prince Rupert Power & Light Company, who are authorized to construct a system, including dam, pipe lines and power houses at or near Woodworth Lake, Shoowahtlans river, in the Skeena river mining division, and to transmit and distribute electricity to various points on the Tsimpsean peninsula, Kaien and Digby islands.

ELECTRICAL PLANT EARNINGS PER CAPITA

Paper read before the C.E.A. Convention by W. A. Bucke, Toronto.

In dealing with such a subject as this it is essential that exact and full information should be available from a large number of plants throughout the district under examination.

When I was first asked to prepare this paper it was thought that such data was available for Canada and that an analysis could be made which would be comprehensive of the whole subject. Upon examination, however, it developed that there was not and had never been any data compiled, and it became necessary to obtain same at first hand. In an endeavor to do this I sent out about one hundred circulars, asking thirty-three questions bearing directly on the matter in hand. Thirty-one of these data sheets were returned to me; some completely filled in, but more having only partial information. Of those received twenty-three were from Ontario and Quebec, three from the Maritime Provinces, and five from the West. Had more time been available it would no doubt have been possible to fill the gaps in some of the data sheets returned, to get explanations of certain (apparent) discrepancies, as well as prevail on many of those who did not reply at all to send in the information desired. This explanation is due to you as an Association, so that you may appreciate why this article, which should essentially cover Canadian companies' operations, is so meagre in this particular.

I quite understand that there are many companies that do not wish what they consider their private affairs to be published, and there are circumstances under which this position is quite tenable; but I feel certain that if they appreciated the fact that the data given would be treated confidentially, most of them would consent to assist. The result would, I feel certain, be beneficial to all. Co-operation is, however, absolutely essential.

That there may be a record of the matter in case further action is considered advisable, I give below the list of questions sent out:

Name of Company?
Address?
Population of City or Town?
Horse-power of prime movers?
Kind of power (water, steam, etc)?
Kw. capacity in generators?
Types of generators?
Number of arc lamps?
Type of arc lamps?
Number of incandescent lamps?
Do. (16 c. p. or equivalent)?
Number of motors?
Total horse-power of motors?
Maximum load (total)?
Maximum load (incandescent lamps)?
Maximum load (arc lamps)?
Maximum load (motors)?
For your last year what are operating expenses (total)?
Cost of coal?
Tons of coal?
What is lighting meter rate?
What is lighting flat rate?
What is power meter rate?
What is power flat rate?
What is revenue from arc lamps?
What is revenue from incandescent lamps?
What is revenue from motors?
What is revenue from other sources?
What is authorized capital?
What is issued capital?
What is amount of preference stock?
What is amount of common stock?
What is bond issue?

This list, while fairly formidable, should be materially supplemented and information in regard to competition from other electric plants, gas, etc., and other local conditions bearing on the subject should be obtained.

A matter which is very little understood and one which at the present time, particularly in Ontario, should be appreciated, is the load factor, this is the ratio which the total kilowatt hours bears to the maximum load in kw.'s multiplied by the hours during which the plant has been in operation. No information is available in Canada at the present time in regard to this item, but I will refer to it later when speaking of results obtained in Great Britain and the United States. It always has been a surprise to me that the operating companies, with few exceptions, do not measure by integrating wattmeters at their stations, the power generated by them. Without such apparatus the station manager cannot know what his load factor is, and consequently is not so alive to the possibilities before him in the way of taking on new business, nor is he in such a position as to intelligently enter into a contract for the supply of power to him; a condition which is certain to be presented to many managers within the next few years.

Believing that the data which I have collected will be most valuable to you if given in the form of a table, I have compiled the following: See table I.

I have eliminated all reference to the company supplying the information, but have included the population served, and mentioned the location as "C" (central)' "E" (east), "W" (west). I also have used the letters "S" to mean steam power, "W" water power, and "G" natural gas power. In the fourth column "A" stands for Arc Lamp Load, "I" for Incandescent, and "M" for Motor Load.

You will note that in the West is to be found the highest gross revenue per capita. The explanation appears to be the high rate charged for current in the smaller town (3rd item), while apparently a good load factor must be responsible in the other case (19th item), as the rates for current are not high. This latter explanation is apparently true also of the last two examples given, as well as others in the table.

As information from the United States in regard to revenues will no doubt be of interest to you, not only for comparative purpose, but as general data, I include the following table, taken from the United States Government Report for 1902, at which time the population to which the various items are referred was 76,000,000.

Location.	Cost. Per cap.	Kw. genrs. Per cap.	Output in Kw. hrs. Per cap.	Arc lamps Per cap.	In. lamps Per cap.
N. Atlantic	12.66	.024	60.31	.0081	.4068
S. Atlantic	1.86	.006	9.86	.0016	.0585
N. Central.	4.86	.015	24.50	.0055	.2346
S. Central.	1.59	.006	10.93	.0017	.0726
Western ..	16.84	.043	82.07	.0074	.4455
Average ..	6.64	.016	32.99	.0051	.2394

This table cannot well be compared with that for Canada, as it is impossible to ascertain the population actually served, the populations referred to being the total populations for the various sections mentioned. It is given as being interesting within itself, as it goes to show the extent to which the current supply business can be developed. In the Western section you will notice that the investment per capita is two and a half times the average cost per capita for the whole United States, and that the number of incandescent lamps is twice the average. In the North Atlantic States the cost is twice the average and the number of incandescent lamps bears nearly the same ratia. It is interesting to note that in Canada in 1905 the cost per capita for electric light and power plants was about $13.

As the results in the Western and North Atlantic States are so much better than in the balance of the districts, and as we are interested only in results which will tend to set a pace for us, I have worked out the following table covering California and New York, two States which may be regarded, I think, as worthy of our consideration, so as to give you at a glance all the important detailed information possible:

1. Ratio of output in kw. hrs. to max. gen. cap. x total hours in year........	21 p.c.	23½ p.c.
2. Income per 16 c.p. lamp	$2.30	$2.15
3. Income per arc light	$64.00	$83.50
4. Revenue per cent. cost	13.6 p.c.	15 p.c.
5. Operating expenses per cent. gross income (no fixed charges)	63.7 p.c.	62½ p.c.
6. Revenue per kw. of generator capacity	$60.00	$89.50

You will notice that the results are strikingly similar except in the matter of revenue per kw. of generator capacity, which is 50 per cent. higher in New York than in California. This is no doubt accounted for by the fact that in the Western State, where water powers are used extensively, expenditures are necessarily large at the seat, and also because the plants are built looking towards large future development, while in the east the demand for current precedes the expenditure.

There is another point which strikes me as being very interesting, and that is the ratio which the maximum generator capacity multiplied by the total number of hours in the year bears to the total output in kw. hours. The figures given are 21 per

TABLE I—SHOWING REVENUES IN CANADA IN 1906-7.

Pop.	Location.	Kind of Power.	Kind of Load.	Lighting Rate. Kw. hour Meter rate	Lighting Rate. 16 c.p. lamp per year Flat rate	Motor Rate. Kw. hour Meter rate	Motor Rate. H P per year Flat rate	Revenue per 16 c p Incandescent Lamp	Gross Revenue per capita	Gross Revenue per cent. capital	Gross Revenue per Kw. of Gen. Capac'y	No. of Incandescent Lamps per capita 16 c.p.	Total Cost per capita	Ratio of Operat'g Expenses to gross Revenue
2300	C.	W. & S.	A. & I.	9c.	None	None	None	$1.34	$3.04	23	$53.80	1.74	$12.90	62
2700	W.	S.	A. & I.	20c.	$15.00	None	None	3.74	6.21	50	106.00	1.5	10.70	65
3000	C.	W.	A. I. & M.	None	$2.50 to $2.00	None	$12.50 10h. $15.00 24h	1.93	5.00	13.5	21.00	1.37	37.00	22
3000	C	S.	A. & I.	10c.	None	None	None	2.56	3.32	—	73.50	1.2	—	83
3500	C.	W.	A. I. & M	10c.	None	None	$20.00	2.00	3.82	13.0	19.00	1.0	30.00	40
3500	C	W.	A. I. & M.	6c.	None	None	$25.00 up to 20 h p. $12.50 over	1.75	2.00	—	17.50	1.1	—	—
5000	C.	S.	A. I. & M.	—		—	—	2.22	3.30	29.0	44.50	.73	12.00	—
5500	C.	W.	A. I. & M.	—	—	—	—	2.17	2.37	21.0	26.00	1.08	11.00	37
7000	C.	W.	A. & I.	10c.	$5.00	—	—	2.81	2.30	10.7	80.00	.70	21.40	28
7000	C.	S.	A. & I.	15c.	$6.00 to $3.00	None	None	3.80	3.07	50.0	45.00	.71	6.20	32.5
9000	C.	S.	A. I. & M.	8.8c.	None	6c. to 3c.	$60.00	1.46	2.48	32.3	55.50	1.1	8.00	65
9800	C.	S.	A. & I.	10c.	None	None	None	1.86	2.03	38.1	73.00	.77	—	51.6
10000	C.	W.	A. I. & M.	5c.	$4.80 to $3.30	None	$22.00 to $10.00	1.91	3.20	30.7	58.60	1.2	10.60	—
10000	C.	S.	A. I. & M.		4.00 to $10.00	10c. to 5c.	$60.00 to $30.00	1.96	2.71	17.6	41.30	1.2	15.50	64
10000	W.	S.	A. I. & M	14c. to 12c.	None	8c. to 4c.	$90.00 to $45.00	3.00	4.80	—	148.00	.7	—	—
10000	C.	S.	A. I. & M.	10c. to 7c.	$6.00	6c. to 3c.	None	1.91	3.19	19.1	45.50	1.0	16.70	50
10000	C.	S. G.	I. & M.	12c. to 7c.	$7.80 to $6.00	5c. to 3c.	None	2.09	2.10	—	52.50	1.0	12.00	65.8
12000	W.	W.	I.	1.8c.	None	None	None	2.96	3.12	—	34.00	1.04	—	—
12000	W.	S	A. I. & M	9c. and 8c.	$9.00	7c. and 6c.	$60.00	—	6.95	60	208.00	1.6	11.70	75
13000	C.	S.	A. I. & M.	12c. to 10c.	None	7c. to 3c.	$36.00 up	1.39	2.31	30	65.00	.58	7.70	—
14000	C.	S	A. I. & M	10c.	None	7c.	None	1.39	1.61	13.5	13.00	.42	—	—
15000	C.	W.	A. I. & M	10c. to 5c.	$6.00	Not given	Not given	1.28	1.07	21.8	13.60	1.5	—	55.7
16000	E.	S.	A. & I.	10c.	$6.00 to $3.00	None	None	2.33	1.47	14.6	58.60	.63	10.00	74
17000	C.	S.	I. & M.	15c. down	None	5c.	None	2.10	1.90	—	77.50	.88	—	—
20000	E.	S.	A. I. & M.	11 1c. to 9c.	$9.00	10c. to 4c.	None	3.20	4.16	—	138.00	1.05	—	52
22000	W.	S.	A. I. & M	Not given	Not given	Not given	Not given	—	2.75	39.0	116.50	—	6.60	49
45000	E.	S.	A. I. & M.	13½c. to 11c.	None	11c.	None	2.96	3.82	—	95.50	1.02	—	—
50000	C.	S.	A. I. & M	9c.	None	10c. to 2c.	$80.00 to $45.00	1.54	2.78	2.78	75.60	.88	10.00	70
70000	C.	W.	A. I. & M	12c. to 10c.	None	3c. to 1c.	$30.00	1.65	2.64	—	41.00	1.0	—	41
76000	C.	W.	A. I. & M	7c.	$2.50	10c. to 2c.	$30.00 & $25.00	1.62	5.48	23.3	64.00	2.42	23.60	55
14[illegible]000	C.	W.	A. I. & M	8c. down	$3.60	3c. to 1c.	None	1.80	5.00	—	—	.78	—	—
				TOTAL AVERAGES					$3.77				$16.00	

TABLE II—SHOWING REVENUES IN UNITED STATES IN 1906-7.

Pop.	No. of Customers	Increase last year	Sales cost of adding 1-16 c.p. lamp or equivalent in cents.	Ltg. rates k.w. hour	Motor rates k.w. hour.	Gross revenue per capita.	Gross revenue per k.w. of gen. capacity	Gross revenue per 16 c.p. or equiv't.	No. of 16c.p. lamps or equivalent per capita
1,350	415	33.4	....	29c. to 2c. avge. say 6c.	Same	8.50	48.00	2.31	3.72
5,000	567	41.0	....	10c.	8c.	6.30	78.76	—	—
15,000	872	23.7	35	10c. down	5c. down	4.27	80.00	2.13	2.0
20,000	1,300	30.	37	12c. to 6c.	12c. to 6c.	2.98	119.00	3.8	1.56
35,000	513	8.	....	20c. to 10c.	10c. to 1.8c.	3.07	53.80	2.55	1.2
80,000	3.000	20.	12	15c. down	8c. down.	5.44	51.17	5.50	1.28
100,000	2,412	102.	21	12c. to 5.3c	7c. to 3.3c.	2.25	45.00	1.81	1.25
278,000	6,964	18.5	21	10c. down	10c. down.	3.57	142.05	2.25	1.58
Average						3.60			

TABLE III—SHOWING REVENUES IN GREAT BRITAIN IN 1906.

Name	Pop.	Total cost per k.w. hr.	Selling price per k.w. hr.	Incand. lamps (16 c.p. or equivalent) per capita.	Gross Revenue per capita.	Total cost per capita.	Revenue per k.w. of gen. capacity.	Rate operating expenses to revenue	Load Factor
Aldernay	11,300	5.2c.	9.22c.	.7	$1.13	$20.00	$52.00	47.8	10.8
Cambridge	50,000	5.0c.	10.5c.	.6	1.90	12.00	47.00	33.0	10.01
Liverpool Dist.	31,700	4.88c.	8.84c.	.76	1.10	8.35	59.50	49.5	11.9
Wolverhampton	100,900	1.54c.	3.22c.	.55	1.35	8.50	45.00	46.3	21.3
Bermondsay........	135,000	1.98c.	3.74c.	.3	.55	4.80	51.00	52.0	29.9

All the above are Steam Plants.
This information is compiled from 1906 data.

Tables Accompanying Mr. Bucke's Paper, on "Revenue per Capita from Electrical Plants."

cent. and 23½ per cent., which appear to me to be very creditable when you remember that the table includes all sizes of plants. These figures must not be confused with load factor. I have before me considerable data on English plants, and from these I find that the average ratio between load factor and generator capacity is 1 to 1.75. If we applied this ratio to the above figures we would find that the load factor was 37 per cent. and 41½ per cent. respectively—rather remarkable results when you consider that the period covered is a whole year. It should be noted, however, that auxiliary generating apparatus is not included in this estimate. You will appreciate this fact more fully when later in this article you see the results obtained in recent practice in Great Britain.

While we are considering results obtained in the United States, I wish to give you some data that can be compared somewhat with that from Canada. This data is arranged according to population, and is intended to be representative of the best modern results. See table II.

The last two columns must not be taken as referring to 16 c.p. lamps, but to their equivalent; the load consisting of arc lamps as well as motors in practically all cases. The revenue per capita in the first two cases cited is rather remarkable. We have, however, in our Canadian list one small central town showing results equal to the second best, and another in the West beating it. On the average, the United States figures given above are about 5 per cent. lower than ours, a very gratifying result. In this latter connection I would ask you to note that the United States companies in the five cases where figures are given, spent from 12 cents to 37 cents per 16 c.p. lamp equivalent for new business; and the managers, with few exceptions, stated that from 3 per cent. to 5 per cent. of the gross revenue could be advantageously spent for this purpose.

Before passing on to results elsewhere, I think it will be interesting to give some figures for the whole of the United States. Figures are available only for the year 1902, and the following are averages for 3,620 stations, both private and municipal, scattered throughout the country:

Ration of output in kw. hours to max. gen. capacity x total hours	23½ p.c.
Income per 16 c.p. lamps	$2.48
Income per arc lamps	$66.00
Revenue per cent. of cost	17 p.c.
Operating expenses per cent. gross income	65.5 p.c.
Revenue per kw. generator capacity	$71.00

No absolute data is obtainable regarding the number of people who could be served by the plants, so the revenue per capita cannot be given with any certainty.

Comparing the above table with that for Canada shows that the revenue per 16 c.p. lamp in the United States is approximately 15 per cent. greater than in Canada, and that the revenue per kw. of generators installed is about 5 per cent. greater.

Were it estimated that one-half the population of the United States were served at the time covered by the above table, and this checks up closely with an estimate based on certain figures given in the United States Government Report, it would appear that the revenue per capital was $2.38 in the United States in 1902, or 35 per cent. below the average of the thirty one plants in Canada for 1907.

Before closing I want to make brief reference to some results obtained in Great Britain. Detailed and complete data is obtainable for scores of plants; the few I refer to in Table III. are picked out at random and serve to illustrate the general results: See table III.

You will note that the number of incandescent lamps per capita is approximately one-half of what it is with us. This is no doubt partly accounted for by the fact that the 8 c.p. lamp appears to be used almost entirely, and all the English data tables refer to this candle power lamp; the revenue per capita is also much below our figures. The fact which I particularly wished to illustrate, however, was the matter of load factor as given in the right hand column. 29.9 per cent. is the best load factor given in a list of some 300 plants, and it falls as low as 7 per cent. It is noticeable that the best load factors correspond with the lowest cost and selling price per kw. hour.

In conclusion I may state that the information contained in this paper was obtained from the United States Government Report, 1902; the Electrical Times, of London, Eng., from a paper prepared by Mr. J. E. Montague, and read a year ago before the National Electric Light Association, and from data collected from the various operating companies in Canada. Should the paper prove of sufficient interest to make the references desirable, the writer will feel well repaid.

The Robb Engineering Company, Amherst, N. S., recently shipped a 60 inch by 10 inch locomotive type boiler, for steam shovel to the Corbett-Floesch Company ,Moncton, N. B.

Among the Exhibits.

The exhibits were a most interesting feature of the C. E. A. convention. Considering the fact that the decision to have exhibits was not reached until a short time previous to the convention, the showing made was most creditable and gratifying.

The Canadian General Electric Company occupied Room 13 with their exhibits, and showed a great many very interesting things. The lower corridor of the convention building was lighted with their flaming arc lamps. The exhibit included a number of novelties as well as many of the company's standard lines of supplies, among them being apparatus for heating, cooking and ignition purposes.

A novelty which exhibited the lasting quality of the C. G. E. apparatus was a six pound sad iron, which was running continuously during the convention. This apparatus has a life of about 3,000 hours. One of its most attractive features is that it can be renewed with great simplicity.

The Canadian General Electric ovens and cooking apparatus in general were highly commented upon by all who investigated them. Quite an up-to-date novelty was that of the exercise riding horse, designed for use in gymnasiums and health resorts. It is in the form of a horse's back upon which there is mounted a saddle and stirrups with a leather grip in front to correspond to the reins. When one is seated upon it and the current is turned on the body moves up and down with an action similar to that of a trotting horse. It can be made to go at various speeds, and the rider experiences many of the delights of a horseback ride. Most of the company's novelties were shown in such a manner as to give a splendid demonstration of the ease with which central stations can increase their light loads by pushing the sale of such apparatus.

The Canadian General exhibited also a Sprague electric hoist, which is remarkable for the complete control the operator has over it. It is made with a capacity of from 1,000 pounds to two tons and requires no skill to operate. This hoist can be arranged upon a traveller and moved about to any desirable position.

One of the C. G. E. oil switches for controlling high voltage A. C. motors was exhibited in such a manner as to enable the delegates to inspect its construction.

A C. G. E. long-burning arc lamp was exhibited along with the company's other lamps, and was so arranged as to show the great simplicity of its working parts.

Among the novelties shown was a humidifier for use in club and smoking rooms, which acts upon the principle of a revolving fan and scatters a fine spray of water throughout the room. The spray can be made very fine or very heavy. Among other things shown by the company, were luminous radiators, tantalum lamp clusters, magnetite arc lamps, Tungsten lamps, and a mercury arc rectifier for transforming A. C. into D. C. wherever D. C. is not available. The company also showed a number of apparatus for use in dental and surgical work, and an attractive line of fan motors. Mr. H. O. Edwards with several assistants was in charge.

The Westinghouse Electric & Manufacturing Company arranged their exhibit with a view to demonstrate the advantages of their small appliances and lighting apparatus, to small central stations. It included a line of small type "R," D. C. and D. A. power motors of small capacities. One of the small motors was shown operating a 1900 washer. There was shown also a complete electrolytic lightning arrester, with its accessories and parts, which has recently been placed upon the market, and is of the very latest design.

The Westinghouse Company showed also a line of oil switches, A. C. and D. C. switchboard instruments, single phase and polyphase watt meters for house services and a full line of portable instruments including a Westinghouse standard portable wattmeter.

The principal part of the Westinghouse exhibit consisted of various types of lamps manufactured by the company. These included the Cooper Hewitt mercury-vapor lamp, standard A. C. portable and A. C. series arc lamps and a metallic flame arc lamp of recent design. These lines were all shown in operation. There was also an exhibit of a full line of the company's standard incandescent lamps of various candle power.

An attractive part of the Westinghouse exhibit was a complete line of Nernst lamps for indoor and outdoor service, of various sizes, together with a full illustration of their parts and accessories.

The exhibit included several excellent photographs showing some of the work done by the Westinghouse Company in the power and lighting line. Those in charge of the Westinghouse exhibit were W. H. Eisenbeis, W. W. Lovell, H. I. Grobbs, A. E. Fleming and M. H. Smith.

The Gas & Electric Power Company, Stair Building, Toronto,

had its exhibit on the main floor. It included a selection of the various articles which the company handle. Among them were some of the Ferranti meters, which attracted much favorable comment because of their simplicity of design. Many enquiries were received regarding the company's direct current circuit breaker, with its automatic release. A special feature of this company's apparatus, is the strength of the materials used in them. There is nothing of a flimsy nature about any of them at all. The exhibit included also a midget enclosed arc lamp of ten hours' duration, which ought to become very popular.

This company handle a great variety of electric apparatus and represent the well known "Electric Construction Company, Limited" of Wolverhampton, England. One of their specialities is the installation of electric plants in coal mines of which they have installed in England, a large number. A. H. Dow and D. F. Hills were in charge of this exhibit.

The Phillip Carey Manufacturing Company, of 112 Bay street, Toronto, exhibited a large assortment of magnesia and asbestos goods of all kinds, especially those used for insulating purposes. The company manufacture in addition to insulation covering, a full line of coverings for high and low pressure steam and hot and cold water pipes as well as a very effective and successful roofing. O. A. Cole, H. E. Rowell and H. W. Cook were in charge of the exhibit.

The Joyner-Greene Company, Stair Building, Toronto, manufacturers' agents and dealers in electric specialities, exhibited an extensive assortment of appliances. One of the most noticeable was the "Dim-a-lite" which not only has the regular features of a high or low incandescent lamp but is also arranged so that it will fit any socket or lamp.

One of this company's novelties is an article called Solderene, a combination of a solder and a flux. Soderene enables one to join any metals, aluminium to aluminium for instance, or copper, brass, lead, zinc or tin without any difficulty. It is expected that this article will soon be manufactured in Canada as well as in Boston where it now comes from.

The Joyner-Greene Company handle the goods of the Weston Electrical Instrument Company of Newark, N. J., makers of one of the best known measuring instruments on the market. Their exhibit included a line of spark coils, used for gasoline engines and automobiles, etc., which have now been on the market for several weeks and promises to become very popular. The Joyner-Greene Company showed also a miniature arc lamp of German design, which they claim is of the highest efficiency, longest life and simplest design of any miniature on the market. They are the sole agents for the Helios arc lighting systems for out door lighting and showed a line of the company's goods. They are also agents for the Federal Electric Sign Company of Chicago, and A. J. & M. Anderson's line material. One of their exhibits was a useful apparatus in the form of the Anderson time switch by means of which, if a man wishes to have his lighting current turned on for a given period of time, say for instance when theatre goers are on their way home, it can be attended to automatically without the need of anybody being present.

The Joyner-Greene Company also exhibited many varieties and sizes of electric signs and other advertising and lighting specialities. An attractive feature of their exhibit was the Federal, street light, direct reading meter suitable for either A. C. or D. C. This instrument is very small and compact and is strictly accurate, meeting the requirements of pole electricians and central station men. Other features of this company's exhibit were Siemen's carbons and the American Electric Fuse Company's protective apparatus. H. Y. U. Joyner and E. A. Greene were attending to the exhibit.

The Universal Manufacturing Company, Chicago, exhibited their flat rate controllor, which they claim enables a company to ascertain accurately the exact amount due to them for current supplied under a flat rate agreement. This does away with all the worries of delicate and easily disarranged meters, and controls absolutely the current supplied. If a consumer through ignorance or dishonesty should try to extract more current than he is paying for this instrument will at once stop him by flashing his lamps. If the normal load is restored an uninterrupted service is renewed. Mr. E. F. Stoll, 28 Wellington street west, is their Canadian representative.

The Hamilton Anchor Company, Limited, exhibited their devices for anchoring telegraph poles and similar apparatus. The "Atlas" anchor and the "Swan" have now come to be used by a great number of telegraph, telephone and electric line companies.

The Canadian Fairbanks Company, Limited, exhibited a number of Fairbanks-Morse dynamos and motors. They also showed the Wizard ignition magnetos for use with gas and gasoline engines. These compact little instruments have a permanent magnetic field and commence to generate on the first revolution of the armature. They have a patent friction drive which they claim is the most durable and simple ever produced. The Orswell system of jump spark ignition was also exhibited by this company. This system has no coils with their sticking vibrators and difficult adjustments, nor any high tension current in the wires or connections. Mr. A. Givens had charge of the exhibit.

J. F. B. Vandeleur, Canadian agent for several British manufacturers, Dineen Building, Toronto, exhibited a large assortment of apparatus. Among these were Evershed & Vignoles' bridge meggers measuring from .01 ohm to 40 megohms. These are neat little instruments which are of great service for testing resistance. They are simple and handy and are put up in various portable types. Other samples of Evershed & Vignoles' apparatus shown were switchboard instruments (plain, sector, round, and edgewise types); recording volt meters and ammeters both ink and inkless types; high range constant volt meggers with guard wire terminal for cable work, 1,000 volts, 2,000 megohms, an instrument of great range, which is used by the Canadian Fire Underwriters.

Other companies represented by Mr. Vandeleur were Berry, Skinner & Company, London, makers of switch gear and motor panels of the patent foolproof type; Connolly Bros., Limited, Manchester, makers of insulated wires and cables and of the Blackley type; the Gilbert Arc Lamp Company, Chingford, Essex, makers of open or enclosed flame lamps, carbons of special design and special systems of A. C. lighting with moving coil transformers; the Morgan Crucible Company, London, makers of Morganite brushes and Battersea Carbon brushes for dynamos and motors; T. H. & J. Daniels Limited, Stroud, makers of gas engines, pumps, suction gas plants and pressure gas plants; Reavell & Company, Ipswich, makers of air compressers for use in mines, tower stations, etc., vacuum pumps, pneumatic hoists, and gas engine starters of special type up to 3,000 pounds per square inch.

The exhibit of X-cells Canadian dry batteries, manufactured by "Electrical Specialities, Limited," 12-16 Shuter street, Toronto, was brightened by the presence of a live cat, electrically speaking. On the front of a large model of an X-cell was a drawing of a black cat with a couple of wire whiskers projecting from its lip, so arranged that when the current was passed through them, it arced across the intervening space, making a bright electric flash and being accompanied by a fierce hissing noise quite suggestive of the real thing.

In addition to their well known "Black Cat" line, "Electric Specialities, Limited," will shortly place upon the market, a line to be called the "White Kitten" No. 6. This is being produced to meet the demand for a cheaper cell which will give satisfaction on light ignition work, as well as in bell, telephone, and similar open circuit work. The selling price is to be very low, viz.: 16 cents in barrel lots, f.o.b. factory.

Electric Specialities, Limited stated that they were receiving many enquiries from delegates to the convention and were contemplating a number of good orders as a result.

At the exhibit of the Midland Electric Company, of Montreal, their representative, Mr. Alvan Woolf, demonstrated the merits of their Kolloid Wolfram lamp. The Midland Electric Company have obtained the sole control of this lamp for the Dominion of Canada, and they claim for it a very high efficiency. The Midland Electric Company fully guarantee delivery of their metallic filament lamps in perfect condition, also their life and efficiency. These lamps are constructed in such a way that all candle powers can be used at any angle.

Mr. Woolf stated that the demand for the Kolloid Wolfram lomp had reached such proportions that the Midland Electric Company has been obliged to turn its business into a joint stock company in order to meet the increased demand.

The Oneida Community, Limited, Niagara Falls, Canada, exhibited several of their well known products, including galvanized chain for suspension of arc lamps. Wilbur L. Earl of Montreal, and G. Raymond Noyes of Niagara Falls represented the company.

The Ontario Power Company, Niagara Falls, showed their standard 60,000 volt insulator and their aluminium cables.

The Ontario Hydro Electric Commission exhibited the tower it has decided to use for its long distance transmission lines.

Hydro electric work is a speciality of Allis Chalmers-Bullock, Limited. In a bulletin distributed among the members of the Canadian Electrical Association during the convention, they illustrated a number of their hydro-electric plants, either in operation or under construction, ranging from a direct connected single horizontal turbine of 360 h.p. for the New Liskeard Light, Heat & Power Company, at Chester Falls, Ont., to one

of three quadruple horizontal turbines each 5,350 h.p., for the Montreal Light, Heat & Power Company, at Soulanges, Que.

The company also undertake the development of water powers, as, for example, at Wabageshik Chute, Vermillion River, Ont., where they have built concrete forebay, dam, and power house for the Moud Nickel Company, Limited. They claim to be the only company in Canada which designs and builds hydro-electric plants complete in all details. The plant of the Mond Nickel Company, Limited, includes a horizontal twin turbine of 2,200 h.p., with 38 inch runners, an exciter turbine of 110 h.p., a 1,200 kw. alternator, oil governers, meters, transformers, and other auxiliary apparatus. Instead of carrying turbines in stock the company has adopted the modern principles of designing them to suit the special conditions of service.

Interference of Transmission Lines.

Perhaps one of the most important cases of interference between two electric companies, is being heard in the City of Chicago, in connection with the application of the American Telephone and Telegraph Company for a permanent injunction restraining the Illinois Traction Company from making alive the high pressure 33,000 volt power transmission wires, which have been erected immediately above the main lines and parallel with the wires of the American Telephone & Telegraph Company through the town of Lincoln, Ill., and in the main street of the town, Chicago street. The case is exciting great interest owing to the fact that the decision will affect such construction at numerous other points throughout the State of Illinois. The result of the case means a great deal to both parties; a better idea can be obtained of the interest taken in this case from the fact that the telephone company's side alone saw fit to employ twenty to thirty of the prominent engineers on this continent. Among those who testified in behalf of the telephone company were F. L. Rhodes, Francis Elliot Cabot, Raymond S. Kelsch, William S. Barstow, E. B. Ellicott, Carl de Muralt, Harold W. Buck, F. B. H. Payne, Morgan Brooks, Lee Summers, Farley Osgood, N. L. Neall, Percy Thomas and William Hoopes.

Business Notes.

Messrs. Ronald & Meredith, British Columbia agents for F. Reddaway & Company, manufacturers of the well known "Camel Hair" belting, have moved their offices from Cordova street to 518 Hastings street, Vancouver.

W. E. Skinner, of Winnipeg, has been employed by the corporation of Portage la Prairie to report on the best method for lighting the city, whether by purchasing the existing plant, installing a new one, or by renewing a contract with the present company. The city will vote on a by-law to expend $100,000 for the purpose.

The Western Fuel Company, of Nanaimo, B.C., have recently purchased a 90 inch double inlet half housed Sirocco mine ventilating fan having a capacity of 200,000 cubic feet of air per minute at 275 r.p.m. or 300,000 cubic feet of air per minute at 405 r.p.m. This fan will be built by the Robb Engineering Company at Amherst, N.S., who have made arrangements with the Sirocco Engineering Company of New York to manufacture their fans in Canada.

The Robb Engineering Company of Amherst, N.S., have recently received orders from their western office for the following: One 24 inch and 48 inch by 30 inch Robb-Armstrong cross compound Corliss engine, which equals 1,100 horse-power, arranged for direct connection to a 750 kw. Bullock generator, for the City of Calgary, Alta; one 13 inch by 14 inch Robb-Armstrong horizontal engine; two 120 horse-power Robb Mumford boilers.

Mr. T. E. Ryder, manager of the transmission department of the Canadian Fairbanks Company, Limited, Montreal, has been appointed manager of the company's St. John, N.B., house. Mr. Ryder is well-known in Montreal, and his many friends will learn of this change of location with great regret. The new appointment offers a wide field in the line handled by the Canadian Fairbanks Company, Limited, particularly gas engines, scales and mill supplies, and the company are to be congratulated in having a man of Mr. Ryder's ability and experience at the St. John branch.

The John McDougall Caledonian Iron Works Company, Limited, have issued a bulletin, No. 105, on power plant equipment, which illustrates and describes the apparatus and accessories for power station plants which they produce. Among the apparatus described are the Erie City water tube boiler, the Erie City stationary boiler, the "Economic" return tubular boiler, the Erie City "Countercurrent" feed-water heaters, the Four Valve engine direct-connected type, the Enclosed High Speed engine direct-connected type, the Knowles patent air pump and spray pipe condenser, the Deane triplex power pump, the Worthington boiler feed pump, and the Double Impulse waterwheel. The bulletin will prove interesting to anyone in need of such apparatus.

A new company, to be known as W. E. Skinner, Limited, has been established in Winnipeg to handle electrical specialties. The company will undertake engineering contracts for complete plants and will handle a number of specialties. Among the specialties will be the Duplex Metal Company's copper clad wire (which is now being supplied to various telephone companies), the Eureka Fibre Insulators, of the Commercial Electric Supply Company, of St. Louis, and the Vacuum Heating Apparatus of the Illinois Engineering Company, Chicago. The company will also be the Western selling agents for the Ontario Lantern & Lamp Company's Shelby and Brilliant incandescent lamps. Mr. Skinner was engaged with the Westinghouse Company for sixteen years, and was their Winnipeg manager for the last two and a half years.

Exhibit of J. F. B. Vandeleur at the Canadian Electrical Association Convention.

Sparks.

The Electric Railway Commission at Port Arthur, Ont., have been authorized to proceed with the double-tracking of the electric railway between Current River Park and the southern boundary of the city. This road is owned and operated by the city.

The special sub-committee of the Hamilton city council, having charge of the street lighting matter, have approved of the plans drawn up by Engineer Sothman, of the Hydro-Electric Power Commission. Tenders for a plant with an output for 675 arc lamps will be received until August 3rd.

Articles of incorporation have been filed by the Saguenay-Quebec Telephone Company, capitalized at $140,000, head office, Montreal, Que., organized to construct telephone lines in the county of Saguenay. J. E. Dubuc, J. E. Coulter, and E. G. Gosselin, all of Chicoutimi, Que., have been elected provisional directors.

Tenders were received until June 27th by the Listowel town council for a complete electric lighting equipment of about 200 h.p. capacity, consisting of gas producers and engines, boilers and steam apparatus, generators, switchboards, transmission supplies, etc. K. L. Aitken, Traders Bank Building, Toronto, consulting engineer.

The annual report of the Winnipeg city electrician contains recommendations for placing the city's electric lighting lines underground and for providing for the cost of placing fire alarm wire in the city's ducts, the cost of which is estimated at $26,-000. Aldermen Fowler and Midwinter are the special sub-committee appointed to deal with the report.

The John Macdougall Caledonian Iron Works were the successful tenderers for the new 12 million gallon pump for the Montreal waterworks. Seventeen bids in all were received. These included Hathorne Davey, reciprocating engine, cost $61,-770, annual charges $22,102; John Macdougall Caledonian Iron Works, reciprocating engine, cost $78,837, annual charges $23,-337; Drummond McCall Company, turbine engine, cost $43,495, annual charges, $24,963; John Macdougall Iron Works, turbine engine, cost $34,595, annual charges $25,598.

Entered the Electrical Field.

A large banner bearing the names "Joyner-Greene" was displayed at the convention of the Canadian Electrical Association. It announced to the electrical people of Canada that one more firm had entered the electrical specialty field. The new firm had opened its office in the Stair Building only a few days previously and its enterprise in arranging for an exhibit before the greater part of its goods were even out of the customs house was the subject of some very favorable comment.

Mr. A. H. W. Joyner.

Messrs. Joyner-Greene are the Canadian representatives of several of the best-known manufacturers of electrical supplies in the United States. Mr. A. H. W. Joyner received his technical education at Finsbury College, London, England. Coming to America he joined the Boston Edison Company as electrical engineer. He remained with this Company for six years, when he became consulting engineer for Messrs. Stone & Webster, the well-known contracting engineers of Boston. After two and a half years' experience with this firm he decided to come to Canada.

Mr. E. A. Greene.

Mr. E. A. Greene is a Canadian. He received his technical training at the Faculty of Applied Science in the University of Toronto. His first practical training was received in the laboratories of the Canadian General Electric Company at Peterborough. Subsequently he spent two years with the Public Service Corporation of New Jersey as assistant engineer of the line department. Mr. Greene has spent the past two years in the Canadian West as a contracting engineer.

Messrs. Joyner-Greene combine practical experience of a varied nature with a thorough knowledge of Canadian conditions. The combination is a good one and we may safely predict for the new firm a large measure of success.

Business Notes.

Ingersoll-Sergeant, of Canada, Limited, Montreal, have issued an attractive circular telling all about their rock drills and mountings for mining, tunneling, quarying and general rock excavation.

The Hyatt Roller Bearing Company's Bulletin No. 31 gives a great deal of information about the company's roller bearing bushing. It is attractively issued in pamphlet form, with a number of excellent illustrations.

The Dunlop Tire & Rubber Company, Limited, of Toronto, have established an office and warerooms in Vancouver, the address being 359 Water street, where they are carrying a full stock of belting, hose, packing and general mechanical rubber goods. This is under the management of Mr. G. W. Seymour and will have charge of the entire British Columbia territory.

The Electrical World, the Street Railway Journal, and the Engineering Record have moved into their splendid new building at 239 west 39th street, New York, where they will continue the publication of their excellent journals and probably improve on them some more. They have published an attractive booklet telling all about their new home and its equipment.

The Croftan Storage Battery Company, Toronto, have issued several interesting circulars descriptive of their products. Among the products referred to are their electric automobile batteries, which are finding enormous demand; their stationary batteries, which are remarkably small in weight and size, and their "Vulcan" combination yacht lighting and engine sparking system.

The Canadian Westinghouse Company, Limited, of Hamilton, have issued an attractive circular relating to their electric fan motors and sad-irons. The circular is daintily bound and handsomely published and includes a number of excellent illustrations showing the usefulness of the company's products. At this time of year when the hot weather is upon us the Westinghouse Company's electric fan motors ought to prove themselves more than popular.

The Board of Railway Commissioners has issued a circular stating that owing to numerous reports which the board has received from its inspectors relating to the poor condition of the lights on a large number of locomotive engines in use on the different railway systems in Canada, it has had under consideration the advisability of requiring the railway companies subject to its jurisdiction to use an electric system of headlights, or some other good system, that will give satisfactory light for the protection of life and property. The board asks companies to file with it in writing, at as early a date as possible, such observations as they may wish to make regarding the proposal.

Publications.

In "The Treatment of Belts and Ropes for Service and Profit," the Cling-Surface Company, of 1032 Niagara street, Buffalo, have presented an attractive series of arguments in favor of the use of their products. The book is tastefully got out and will be found to contain a number of useful pointers for engineers.

The Bruce-Meriam-Abbott Company have issued a catalogue relating to their vertical gas engine for electric lighting, pumping and general power purposes. The company claim that by the use of gas engines, the small or medium size power plants are able to realize an efficiency and economy which far surpasses the results obtained even by the largest steam plants. The pamphlet is entitled "Catalogue A," 1908 edition, section one.

"Polyphase Induction Motors" are treated by Allis-Chalmbers-Bullock, Limited, in their bulletin No. 301. The phenomenal development of alternating current for general purposes, they say, has been largely due to the perfecting of the induction motor, and that motor, built by the Allis-Chalmers-Bullock, Limited, combines mechanical simplicity and high electrical efficiency. Among the advantages claimed by the company for their motor, are, that because of its simplicity of construction it withstands hard usage and runs continuously with a minimum of attention; that it will carry large overloads for considerable time without injury; that the absence of a commutator makes it more reliable, reducing cost of maintenance and repairs and does away with sparking.

The British Insulated & Helsby Cables, Limited, Power Building, Montreal, Que., have issued an attractive B. I. handbook, containing a description of their principal manufactures and a considerable amount of general information of use to electrical engineers. Much hitherto unpublished information of a technical nature is included. Both a "general information" index and a "catalogue" index, which are included, add greatly to the usefulness of the book. The catalogue index represents a fairly complete list of the company's manufactures, but naturally they could not all be described fully in a single book. The company, therefore, will furnish further information whenever requested. The book is well bound in limp leather; is printed upon fine calendered paper, and contains a great number of splendid illustrations.

"Explanations of Switch and Signal Circuits" is the title of a publication issued by Doran & Kasner, 71 Nassau street, New York, in the form of a handy pocket-book. The book is not intended to cover either theoretically or practically the study of electricity in its entirety, but to explain as clearly as possible all that would be of value to the average constructor or maintainer. Regarding the object of signals, the introduction says that they are used and intended as a safety arrangement for the prompt handling of trains. This signal system is intended to reduce to a minimum the handling by human agency with the object of: 1st, safeguarding the travelling public from possible errors on the part of men engaged in the operation of a railroad; 2nd, allowing the swift execution of all train movements. The mechanical and electrical parts of this system have been arranged so that it is impossible for anyone engaged in its operation to give or cause to be given a wrong switch or signal. This arrangement makes the system one of the best in existence, and the railroad protected by it is claimed to be absolutely safe. Owing to its handy form and numerous illustrations, the book should prove an extremely useful one.

"Telephone Construction, Installation, Wiring, Operating and Maintenance," are dealt with in a book written by W. H. Radcliffe, E.E., and H. C. Cushing, Jr., E.E. The book, which is of a handy pocket size, will be found useful for reference and as a guide to electricians, wire men, engineers, contractors, architects, and others interested in standard telephone practice. It includes chapters upon the principles of construction and operation of telephone instruments; approved methods of installing and wiring them; the means of protecting them from lightning and abnormal currents; their connection for operation as series or bridging stations; rules for inspection and maintenance; line wiring and the wiring and operation of special telephone systems. The reader is assumed to know nothing of telephony, and no intricate mathematics are used, nor is mention made of any apparatus, circuits, or systems which are not thoroughly illustrated and described. The book is published by the N. W. Henley Company, 132 Nassau street, New York.

An excellent treatise upon the steam turbine by Robt. M. Neilson has been published by Longmans, Green & Company. The book has already gone through three editions, and this, the fourth, is revised and enlarged. The author states that his aim has been to render the subject intelligible to the average engineer who has had a fair, but not necessarily very extensive, scientific training. It describes not only the principal parts of the leading types of steam turbine, but also the small details, which, in the case of this motor, have such a preponderating influence in determining success or failure. The theory of the action of the steam turbine is also treated of. The mathematical reasoning has been made as simple as possible, and the results of tests of steam turbines given in the book have been carefully selected. The subject is exhaustively treated in some six hundred pages, which are attractively printed and contain many excelent half-tone illustrations and diagrams.

British Association's Winnipeg Meeting.

The Council of the British Association for the Advancement of Science has nominated Professor J. J. Thomson, F.R.S., Cavendish Professor of Experimental Physics in the University of Cambridge, to be president of the meeting of the association which is to be held at Winnipeg next year. The investigations carried on by Professor Thomson in the Cavendish laboratory, and by the distinguished men of science who first worked under him and received inspiration from his researches, laid the foundation for the new views held by chemists and physicists as to the electronic constitution of matter and the remarkable properties of radio-active substances. In 1894 Professor Thomson was awarded one of the royal medals of the Royal Society, and to this was added in 1902 the Hughes medal in recognition of his contributions to the advancement of electrical science, especially in connection with the phenomena of electric discharge through rarefied gases. Two years ago he was the recipient of the Nobel prize for physics. It is understood that provision will be made by the Canadian Government in the estimates for the coming financial year for a grant of twenty-five thousand dollars towards the expenses of the Association's visit to Winnipeg. The City of Winnipeg itself proposes to make a grant of five thousand dollars. The week of the meeting will probably be from August 25 to September 1, 1909.

Sparks.

The Twin City Coal Company, of Edmonton, Alta., have recently purchased an 80 h.p. Robb-Mumford water tube boiler.

The Dominion Coal Company, of Glace, C.B., have recently ordered a 16 inch by 16 inch Robb-Armstrong automatic engine for driving a mine ventilating fan at their No. 6 colliery.

The British Insulated & Helsby Cables, Limited, of Montreal, has just closed a contract with the Montreal Light, Heat & Power Company to supply and install about $50,000 worth of extra high tension three core cable, the work to be completed to enable the mains to be used this fall.

The Royal Bank of Canada have retained Mr. R. S. Kelsch in connection with the lighting of their new building, St. James street, Montreal. This new bank building is one of the finest on the continent. Special attention has been given to the lighting of the building. The fixtures will be furnished by the Enos-Oxley, Limited, and it is expected that they will be among the finest in Canada or the United States.

A general meeting of the members of the Maritime Electrical Association will be held in the Telephone Building, Halifax, on Tuesday, July 28, to consider winding up the affairs of the Association. The executive committee consider such action necessary, because of the lack of interest in the Association's work on the part of its members, and also because of the formation of the Nova Scotia Society of Engineers, whose scope includes matters of interest to the electrical profession, thus doing away with the necessity of a separate organization for electrical purposes.

R. S. Kelsch, Consulting Engineer, Montreal, has ordered the starting equipment for starting the 750 kw. generators in the Canadian Pacific Railway Company's power plant at Fort William. These generators, which have been out of service for about a year, will be disconnected from the engines and run at certain periods as synchronous condensers to raise the power factor from 60 per cent. to 95 per cent. The Canadian Pacific Railway Company now purchase their power from the Kaministiquia Power Company, and owing to the nature of the work, which is principally elevator work, where induction motors must be employed, the power factor, owing to the character of the load, is extremely low. The new arrangement, however, will bring the power factor near unity.

MOONLIGHT SCHEDULE, FOR AUGUST.

Date.	Light.	Date.	Extinguish.	No. of Hours
Aug. 1	7 40	Aug. 2	4 10	8 30
2	7 40	3	4 10	8 30
3	7 40	4	4 10	8 30
4	7 40	5	4 10	8 30
5	10 00	6	4 10	6 10
6	10 40	7	4 10	5 30
7	11 20	8	4 20	5 00
9	0 20	9	4 20	4 00
10	1 20	10	4 20	3 00
11	No Light	11	No Light	
12	" "	12	" "	
13	7 30	13	10 00	2 30
14	7 30	14	10 30	3 00
15	7 30	15	11 00	3 30
16	7 30	6	11 30	4 00
17	7 20	18	0 00	4 40
18	7 20	19	0 30	5 10
19	7 20	20	1 10	5 50
20	7 20	21	1 50	6 30
21	7 20	22	2 40	7 20
22	7 20	23	3 30	8 10
23	7 20	24	4 20	9 00
24	7 10	25	4 30	9 20
25	7 10	26	4 30	9 20
26	7 10	27	4 30	9 20
27	7 10	28	4 30	9 20
28	7 10	29	4 40	9 30
29	7 10	30	4 40	9 30
30	7 10	31	4 40	9 30
31	7 00	Sept. 1	4 40	· 40
		Total		192 50

Sparks.

The Fort Pelly Telephone Company, Fort Pelly, Sask., are planning extensions to their plant.

The Humboldt Light, Power & Telephone Company, Limited, Humboldt, Sask., have been incorporated.

The Lumsden Radial Telephone Company, Lumsden, Sask., has been organized to build and operate a telephone system.

The Bella Coola Telephone, Light & Power Company, Limited, Bella Coola, B. C., has been incorporated with a capital of $25,000.

The Winnipeg City Council have decided to sell $600,000 bonds for the construction of the plant now being built at Lac du Bonnet.

The recently incorporated Royal City Gas Improvement Company, New Westminster, B. C., capitalized at $150,000, may erect a modern plant.

The Winnipeg Street Railway Company have decided to extend their road through the municipality of St. Vital. Wilford Phillips is general manager.

The recently incorporated South Leeds & Pittsburg Rural Telephone Company, Gananoque, Ont., expect soon to commence the construction of an up-to-date system.

The James Stuart Electric Company have been negotiating with the city of Winnipeg with a view to the erection of a factory for the manufacture of water meters.

Articles of incorporation have been filed for the Saltcoats Telephone Company, Saltcoats, Sask., capitalized at $25,000. About 50 miles of line will be erected. W. H. Hallett is secretary-treasurer.

Work on the construction of long distance lines to Broughton, Greenwood, Dunbarton, Audley and other towns is shortly to be undertaken by the Markham & Pickering Telephone Company, Markham, Ont.

The Yarmouth Street Railway Company, Yarmouth, N. S., are planning to purchase a 300 kw. generator, turbines and hydraulic equipment. Extensions will also be made to the car house. B. G. Burrill is president.

F. W. Northcott, purchasing agent, Victoria, B. C., will receive tenders until July 20th for supply and erection of horizontal cross-compound pumping engine, steel tank and tower, and concrete and steel water tower.

The Hamilton Tube Company, Hamilton, Ont., recently incorporated with a capital of $50,000, have acquired five and a half acres of land northeast of the old Hoepfner building on Sherman avenue, where they will erect a plant and engage in the manufacture of steel tubes.

At a recent meeting of the ratepayers of the municipality of Argyl, Sask., it was decided to at once make arrangements for the construction of a municipal telephone system. Tenders for the construction of the lines will be called for at once. Walter Mahon, reeve, is interested.

Application for charter will be made to the Legislature by the Morrisburg Electric Railway Company, Morrisburg, Ont., who plan the construction of an electric railway through Williamsburg, Winchester, Chesterville and Morewood, to Russell, with a branch line to Winchester.

R. S. Kelsch, Consulting Engineer, Montreal is installing a 2,000 kw. generator, 1,000 kw. transformers, high tension switchboards, etc., for the Ottawa & Hull Power & Manufacturing Company. The Canadian General Electric Company who have the contract for this apparatus are now erecting the same, and the new plant will be in operation in August.

At a recent meeting of the Port Arthur city council and Board of Commissioners it was practically decided to follow the power improvements along the Current river as outlined by Cecil B. Smith. The city have proceeded to undertake the improvements of the Onion Lake dam, the construction of a new reservoir above the power house, to increase the height of the dam eight feet, and repair the flumes destroyed by the flood.

An arrangement has practically been effected by the Westmount city council with the Montreal Water & Power Company in regard to the water supply, the company agreeing within eighteen months to instal a new intake 800 feet up the stream and 1,900 feet from the present well. If the city demand a filtration plant, the company will supply it at an increased cost of 27½ per cent. After final approval of the city council, the propositon will be submitted to the ratepayers.

Sparks.

The Winnipeg Board of Contrl have instructed the city electrician to prepare plans and estimate cost of illuminating the city hall during the exhibition.

The Stratford city council have decided to submit another bylaw to the people to make a contract with the Hydro Electric Power Commission for electrical energy.

P. W. Sothman, Chief Engineer of the Hydro Electric Commission, Toronto, has announced that the right of way from Niagara Falls to Toronto has been secured. The Commission have decided to place the main switching station near Dundas.

R. S. Kelsch, Consulting Engineer, Montreal, is installing two 1,200 kw., 60 cycle generators, exciters, switchboard, etc., for the W. C. Edwards & Company, Limited, Ottawa. The power house is laid out for five units. The first unit is now being erected and the plant will be in operation within sixty days.

The Vancouver Power Company will build a permanent concrete dam at the outlet of Lake Coquitlam, about eight miles from New Westminster Junction, B. C., and contractors are invited to instruct their representatives with a view to submitting specifications and tenders. The dam will be approximately 200 feet wide at crest and over 300 feet over abutments, and about 60 feet high.

Sparks.

The Nissouri Telephone Company, Limited, Kintore, Ont., have obtained a charter.

A telephone line is to be built from Barrie, Ont., to Oro Township. H. J. Tudhope, Rugby, Ont., is interested.

The construction of a rural telephone system has been definitely decided upon at Hamiota, Man. Joseph Andrews is interested.

The Yorkton Northwest Telephone & Electric Light Company are making arrangements for the construction of a telephone system at Springside, Sask.

The recently incorporated Brandon Generator & Carbide Company will establish premises in Brandon for the manufacture of gas engines and other supplies.

The Alnwick Independent Rural Telephone Company, Limited, has been organized at Alnwick Township, near Cobourg, Ont. E. W. Harper, of Roseneath, Ont., is president.

The New Brunswick Telephone Company, of St. John, N.B., have been granted the right to lay conduits in Charlotte street, from corner of King to Duke street, and also in Princess street.

There is a vacancy at Edmonton, Alta., for a city engineer and applications for the post will be received by F. M. C. Crosskill, secretary-treasurer, until July 14th. The salary is $3,000 per annum.

The time for submitting tenders for transmission lines, Toronto—Niagara Falls and St. Thomas—Niagara, has been extended by the Hydro-Electric Commission to July 15th. Hon. Adam Beck, chairman.

The Ontario Distributing Company are seeking a by-law from the Lincoln County Council to construct an electric line from St. Davids, Ont., along the Queenstown and Grimsby road, to the crossing of the Michigan Central.

C. H. Mitchell, consulting engineer, Toronto, has been engaged by the Creston Electric Light & Telephone Company, Creston, B.C., to report upon a scheme to generate light and power from the Goat river falls. George M. Benney is president.

At a special meeting of the New Hamburg, Ont., council, a resolution was unanimously adopted authorizing the reeve to sign the Hydro-Electric Niagara power agreement to contract for 250 horse-power for the use of local industries and municipal purposes.

The Central Heat, Light & Power Company have placed, through Laurie & Lamb, consulting engineers, Montreal, an order for a fourth Belliss engine for their power house, St. Peter street, Montreal. This engine will be of 130 h.p., with 25 per cent. overload capacity.

The city of Montreal have ordered one of the Belliss engines of triple expansion type, 750 to 800 h.p., for the low level pumping station. The engine will be directly connected to a Worthington centrifugal pump. The contract for the installation was taken by the John McDougall Caledonian Iron Works Company, Limited, Montreal.

The Toronto University authorities are stated to have in contemplation a scheme for heating all their buildings from one central plant. The proposal is to erect this new plant near University College and convey the steam to the different buildings by means of underground pipes, protected by asbestos coverings. The total estimate cost is $250,000.

OKONITE

TRADE MARK
Reg. U. S. Patent Office

THE STANDARD FOR RUBBER INSULATION

Okonite Insulated **Wires and Cables**

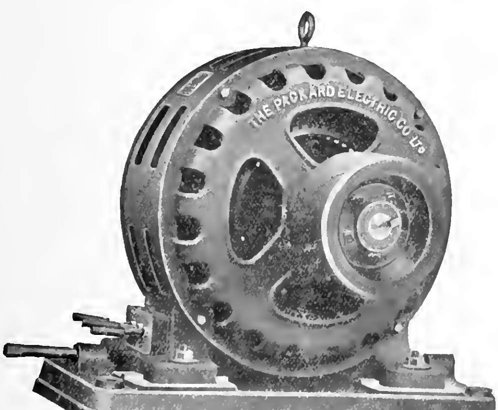
maintain their high electrical efficiency under the most exacting conditions. They are not affected by extremes of temperature, commercial acids or alkalies. They improve with age.

The plain insulation [without a protective covering] is soaked three days in water before being tested.

Willard L. Chandee } Managers.
H. Durant Cheever }
Geo. G. Manson, General Superintendant.
W. H. Hodgins, Secretary.
W. C. Chandee, Assistant-Secretary.

The OKONITE COMPANY, LIMITED
253 Broadway, NEW YORK, U.S.A.

Induction Motors



RUGGED DESIGN

HIGH POWER FACTOR

LOW TEMPERATURE GUARANTEES

Bulletin 100

The PACKARD ELECTRIC CO., Limited
Works: St. Catharines

127-129 Bell Tel. Bdg., MONTREAL. Somerset Block, WINNIPEG.

Time at Sea by Wireless.

If the proposal presented to the French Academy of Science recently by Bouquet de La Gyre be adopted, the Eiffel Tower will play an important role in shipping matters. M. de La Gyre proposes to equip the tower so that it can send the exact time according to the meridian of either Paris or Greenwich to every ship equipped with wireless telegraphy. He claims that a wireless plant of sufficient force can be established to send Hertzian waves completely around the world. By a pre-arranged signal either noon or midnight would be indicated and ships would thus be able to regulate their own chronometers and learn their exact longitude with less danger of making mistakes. The proposal has already been accepted in principle, and experiments will first be undertaken with the concurrence of French ships in both the Atlantic and the Mediterranean. It is purposed to send the hour of midnight according to Paris time, this being preferable to noon, owing to the absence of local disturbances.

Lighting of Large Interiors.

In a paper entitled "Illuminating Engineering," before the recent convention of the Electric Light Association at Chicago, W. D'A. Ryan discussed the various methods of illuminating interiors now in use. He expressed the opinion that as time advances concealed and semi-concealed methods of lighting as applied to large interiors will become more general, and the painfully exposed high-intrinsic-brilliancy sources of light, so common to-day, must necessarily vanish as the public becomes educated to higher standards of illumination. As an example of the cases where for architectural or other, reasons it is desirable to light large spaces by totally concealed sources, mention was made of the arrangements for illuminating the waiting room of the new Union Station at Washington, D.C., by means of inverted arc lamps. The arc between the carbon electrodes of the lamp is arranged to form above the mechanism, and in this particular case the lower electrode is positive. The reflector is adjustable so that the light can be turned to the proper place on the ceiling or side walls, and a diffusing screen covers the arcs so as to eliminate strong contrasts. Notwithstanding the large cubical contents of the waiting room and the fact that the lamp arrangement is of the totally concealed class, the efficiency is remarkably high and compares favorably with exposed sources, due to the fact that the excessive intrinsic brilliancy of such sources is entirely eliminated by the system and the eye is permitted to adjust itself properly for the general illumination.

The Canadian Crocker-Wheeler Company, Montreal, have issued several new bulletins which will prove of interest to all electricians. The subjects of the bulletins are as follows: No. 96, alternating switchboard panels; No. 100, form I. machines; No. 101, form D. machines; No. 102, A. C. switchboard panels. Bulletin No. 103 gives a complete account of the sanitary district of Chicago's hydro-electric development on the Chicago drainage canal, in which there are four 4,000 kilowatt 3-phase 60 cycle alternating current generators and two 350 kilowatt direct current exciter units, built by the Crocker-Wheeler Company heat, as the wire having outer braid slicked down with of Ampere, N.J.

CANADIAN
ELECTRICAL NEWS
& ENGINEERING JOURNAL

PUBLISHED ON THE FIFTH OF EVERY MONTH BY
HUGH C. MACLEAN, LIMITED,
TORONTO, CANADA

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362
MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative
WINNIPEG - - - - Telephone 224. 404 Travellers Bldg
ROLAND F. HILL, Representative
VANCOUVER - Telephone 2248. Molsons Bank Chambers
GEO. A. GALL, Representative

ADVERTISEMENTS.

Advertising rates sent promptly on application Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.

The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

The Hydro-Electric Campaign.

Since the Power By-law carried in Toronto last January, there have been many predictions made that nothing would ever come of the matter, notwithstanding the endorsation of that city. These opinions were very much strengthened some five or six weeks ago when the commission extended the time for receiving tenders for the transmisson line, it being the not unnatural feeling, in view of the general suspicion which seems to surround all governmental enterprises, that this was but the beginning of the end. However, the new date has come and gone without any further extension, the tenders have been opened, and preliminary statements have been made to the effect that they are within the estimates, so it may be fairly assumed that we are almost launched into a practically unparalleled scheme of municipal ownership and operation. At any rate, the near future will surely tell just about what is going to happen, in fact some definite announcement may be made as to the letting of contracts before this issue goes to press.

In the meantime Toronto is exhibiting the usual characteristics of any body so cumbersome as a municipality, nothing much having been done other than to employ an engineer from the States to advise the council in their preliminary investigations. In fact, in view of the predilections which Canadian corporations, both public and private, seem to have for everyone but Canadians, it may very possibly be that some one of our friends from across the line will receive the appointment of electrical engineer to the city. Hamilton also has followed Toronto's lead, having decided that it was necessary to go outside the country for advice during their negotiations with the Cataract Company. Truly, a prophet hath no honor in his own country.

The 1908 Convention.

The 1907 convention of the Canadian Electrical Association was remarkable in several ways, for instance, the excellent exhibition with which it was accompanied, a fall instead of a spring session, etc., and in these ways, as compared with 1908, it had the advantage over the latter meeting. Notwithstanding this, however, the convention held in June last was most highly successful, in fact many were heard to remark that it was the best they ever attended. In the first place the School of Science buildings, which the University of Toronto so kindly placed at the disposal of the Association, proved to be admirably suited to such a gathering, and as such were a great boon as compared with anything that can ordinarily be obtained. When the University was first proposed as a meeting place there was some hesitation on the part of the local committee, it being thought that perhaps there would be great difficulty in getting members to attend the meetings if held at any other than a central down-town point. However, experience proved otherwise, the reason perhaps being that, in the absence of any headquarters hotel, the majority of the delegates had to go out in any case, and it was of course as easy to go to the Park as anywhere else. The situation was also materially helped by the free transportation so kindly provided by the Toronto Railway Company, an accommodation that was much appreciated by everyone, both member and guest, who was able to display the Association's badge.

The local committee decided, in view of the excellent accomodation offered, that it would be desirable to considerably amplify the few exhibits which have hitherto been displayed at conventions, excepting of course last year, and so made arrangements for a display on a very much larger scale than usual. Unfortunately, though, owing to the announcement being made only about two weeks before the meeting, it was impossible to get together anything but comparatively standard material, and that from but a limited number of manufacturers. Notwithtsanding this the devices shown were very attractively displayed, and formed no mean addition to the standard programme.

The papers on the whole presented a radically different tone to those that have been formerly presented, being generally on commercial and operating topics rather than technical. The thin edge of this wedge was introduced last year in Montreal, without doubt it is one of the best moves that the Association has made for some time. The discussions thereon were only fair, on the average, though some papers were pretty thoroughly threshed out. Perhaps the limited amount of discussion was due to the fact that there did not seem time for anything but the paper itself. If this be the reason it might be desirable to consider shortening the list of papers at the next convention, as it is without question a very great pity to unduly limit the discussion.

The local Committee are certainly to be congratulated on the very excellent programme provided for the entertainment of the members and guests. The moonlight sail on Wednesday night was very enjoyable, as

was also the ladies' drive and sail on Thursday. Scarboro Beach on Thursday night doubtless drove away many a pain, because the human body cannot ordinarily entertain two sets of pains at the same time, a very successful convention being brought to a close by a most spectacular baseball match, an innovation that will doubtless from now on be made a permanency.

The Elements of Light and Their Application.

Owing to the enormous changes which are now going on in the lighting field, due to the introduction of the metallic filament incandescent lamps and flaming arc lamps, the subject of light and its most proper and economical use, which is the science of illumination, is naturally receiving much more than ordinary attention. In view of this, and the really great importance of the subject, we thought that our readers would be interested in a continuance of the matter, the subject having been previously taken up in the May editorials.

The standard unit of light in England and Canada is that amount of light emitted by what is known as the English Parliamentary Candle, which is one weighing one-sixth of a pound, and burning at the rate of 120 grains per hour. The standard for the greater part of the continent is the light given by the Amyl Acetate lamp, a type designed by Dr. Von Hefner, and hence known as the Hefner unit. It is 88 per cent. of the English candle, that is, the hefner is the smaller quantity, so that the efficiency of any given light producing device is always higher when rated in hefners, or hefner candle power, than if its output be measured by the English standard. This latter was the unit used in the States up to last year, but was then superseded by the hefner, the A. I. E. E. adopting the latter at the 1907 convention, in that their future standard candle was specified to be 100-88 of the hefner. The change however, makes no practical difference to any commercial work, as the unit is still the same in value, being simply given a different base, a point affecting laboratory work only. Canadian practice, however, is being affected a little just now in that Tungsten lamps, coming as they mostly do from Austria or Germany, are being quoted in the original or hefner ratings. This, of course, makes quite a difference as compared with our usual method of rating in English candle power. Consequently, when speaking of Tungsten lamps one has to enquire which basis is being used. The hefner rating is the explanation of the efficiency of one watt per candle so frequently claimed for this type of lamp, the equivalent rating in English candle power being $1\frac{1}{4}$ watts per candle. In this connection it is interesting to note that a recent authority gives the following as the efficiencies, in watts per mean spherical candle power, of different sources of light. Mean spherical candle power is the average of any number of measurements made in all directions round any light producing medium, and is thus a measure of the total volume of light emitted by the particular device in question. It is now generally accepted as the only correct and proper basis for comparing different kinds of lights.

The unit of illumination is the candle foot, which is the light falling on any body placed one foot away from a light of one candle power. A two-candle power light gives an illumination of two candle feet one foot away from it, and other candle powers in proportion. The illumination decreases as the square of the distance between the source of the light and the object illuminated, so that at two feet away a one-candle power lamp will give an illumination of $\frac{1}{4}$ of a candle foot, at four feet away a 16 c. p. lamp gives one candle foot, etc. This principle, known as the law of inverse squares, is true in a general way of all lighting, though strictly speaking it does not hold except where neither reflection nor refraction are present, for instance, a high candle power lamp in a comparatively small room, the walls of which were mirrored, would be an instance where it would be absolutely inapplicable. The same would be true of a searchlight, as the rays from it, being gathered together by the reflector and thus sent out in a comparatively solid beam, distribute themselves over an area which increases but little with increased distances from the lamp. Consequently the light given by this device does not diminish very much by increased distribution, the governing point being the absorption of the atmosphere, and in that way searchlight illumination is far from obeying the law of inverse squares.

Ruins of Paquette Dam Photograph Taken from Top of Undisturbed Portion of the Structure.

The Paquette Dam Failure.

Messrs. Smith, Kerry & Chace, Consulting Engineers, Toronto, have just finished preparing specifications for two dams for Port Arthur, Ont. One of these is to take the place of the Park Reservoir dam, which was partly destroyed during the recent flood and the other is to reinforce the storage dam at Onion Lake on the Current river.

In connection with this the accompanying illustration will prove interesting. It shows the Paquette dam, which failed, and was the cause of the disastrous flood.

It is situated about eight miles up from the mouth of the Current river, a small river which drains about three hundred square miles of land. The major parts of this area was located above the dam. The dam was built as a retaining wall, partly on rock and partly in midstream on a gravel foundation. There has been no thorough investigation of the failure, but it is a general opinion that it was due to undermining in the gravel, and that, notwithstanding that a great mass of gravel had been piled up on the upper side of the dam to prevent leakage. While the dam was designed as a retaining wall, there were openings, with a spillway above the rock; so it was not because of overflow, that it was undermined. Some parts of the dam were carried by the flood a distance of one hundred yards down the stream. One slab, as is clearly shown in the illustration on the distant shore, fell up stream. It will be seen also from the illustration that there is evidence that the buttress was not built as a unit with the dam.

Tenders in accord with the specifications prepared by Messrs. Smith, Kerry & Chace will probably be called for shortly.

Price of Power.

A subscriber writes "The Electrical News" as follows: "In the June number of your journal, I noticed an item in regard to the price of power which is to be supplied to the City of Toronto, by the Hydro-Electric Power Commission. I would like to ask if the price given, namely, \$18.10 per horse power, includes the maintenance and interest charges on the transmission line, or has the City of Toronto to pay the maintenance on the transmission line and contribute their share of the cost of construteion as well as pay \$18.10 per horse power?"

In response to the above enquiry, the Hydro-Electric Power Commission writes us as follows: "The price given the City of Toronto, namely, \$18.10 per horse power, includes all charges, including interest, sinking fund, depreciation, insurance, maintenance of transmission lines and transformer stations, operation and administration."

Sherbrooke's Municipal Plant.

The City of Sherbrooke, Que., recently took over the gas and electric plant of The Sherbrooke Power, Light & Heat Company. The price paid was \$250,000. A committee of four was appointed by the aldermen and named the light committee, consiting of C. G. Thompson, Chairman, D. McManamy, F. N. McCrae and D. O. E. Denault. This committee made all the arrangements in the taking over of the plants—and retained the staff of the company, Messrs. A. Sangster, superintendent and R. N. Robins, cashier. The gas plant is water gas. The machinery has been in use a few years and will be replaced in the near future by an up to date water gas apparatus, as fuel gas is much in demand and extensions are being made in a number of streets.

The electric light and power plant has lately been changed to 60 cycles,—an entirely new station having been built. There are two new sets of water wheels—700 horse-power each, manufactured and put in position by the Jenckes Machine Company, Sherbrooke. The two sets of wheels are entirely separate as to gates and regulation, and may be shut down and examined without interfering with the other sets, there were also two separate smaller wheels put in to drive exciters.

Two generators of 500 k.w. each, from the Canadian General Electric Company, were put in direct-connected to the water wheel shaft, running at 225 r.p.m. also two separate exciters direct-connected—each excite three 500 k.w. generators.

A third generator has been ordered of 400 k.w., from the Canadian General Electric Company, to be put in place and be running by October 1st. This 400 k.w. will be direct-connected to another set of wheels of 700 horse power. A fine switchboard was put in by the Canadian General Electric Company, with the latest instruments and oil switches. There are about 700 horse power in motors in use at the present time, and they are being added to continually. The lights installed number over 27,000, and additions are being made every day. The light committee will manage the business on the same lines as the company, regarding prices for power and light, collection for street lights, payment of taxes—municipal and school. The committee will be entirely separate in their business though under the control of the aldermen.

Mr. R. S. Kelsch, consulting engineer, Montreal, was the engineer for the new station and machinery.

Fort William Pays \$52,000 for Electric Railway.

A decision has been given by the Ontario Railway and Municipal Board in relation to the taking over by Fort William, Ont., of the portion of the Port Arthur street railway located in Fort Wliliam, and one-half of the rolling stock of the Port Arthur Street Railway.

Port Arthur originally obtained the right to operate its line in Fort William for twenty years from December 1st, 1893, after which Fort Wililam was to have the right to acquire the railway at a price to be mutually agreed upon, or settled by arbitration. The decision adjudges the actual value to Fort William of the street railway to be acquired, as \$52,000, covering roadbeds, rails, plant, overhead construction and appurtenances, a proportion of the cars (cars 7, 8, 10, 11, 14, 18 and 24) and their accessories, the motor generator in the transformer station of the Kaministiquia Power Company in Fort Wililam, and the real estate.

The value of the probable earnings until December 1st, 1913, of the section acquired by Fort William, was also to have been decided upon and included in the decision. Port Arthur, however, was unable to submit evidence on this point. An agreement was therefore drawn up and embodied in the award which provides that the Ontario Railway and Municipal Board shall pay out of earnings all operating maintenance and repair costs, to Fort William, and turn over the balance to Port Arthur.

Mr. Mellis Ferguson, of Kingston has been appointed city engineer of Stratford, to succeed former city engineer Griffiths, who recently resigned, to confine himself to county and other work. Mr. Ferguson is a son of Professor Ferguson of Queen's University, Kingston.

Prof. L. A. Herdt of McGill University, has returned from England where he attended to some business concerning a proposition in the interests of Messrs. Smith, Kerry & Chace, consulting engineers, Toronto. During his trip Prof. Herdt visited London, Paris and Norway.

Methods of Increasing the Station Load

Paper read before C. E. A. Convention by Geo. Williams, New York.

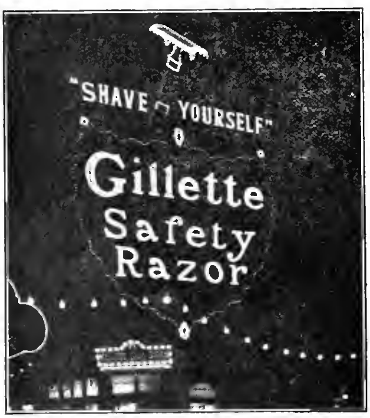
It is presumed that the Central Station is prepared for additional patronage and that the increase will be composed of profitable business.

From this point the station is a commercial institution, and whether large or small a selling campaign should be inaugurated.

The selling campaign may be conducted by an organization exclusively devoted to the work, or may be carried on by one man who will devote part of his time to this special line, but the same old laws of commerce which govern the success of any mercantile business are applicable to electrical development and there is no special personal requirement or equipment requisite or necessary which cannot be quickly acquired by the organization and the salesmen.

The object of the campaign is to sell a service and the greater the variety of purposes for which the service can be applied, the broader the field of sale. There is in every community a possibility of annual sales amounting to $10 per capita, and when that standard will have been reached it will be found easier to add patronage than at the present time. The volume of additional business is limited more by our plans to get it, than by the opportunities for selling the service. The point of saturation has never been reached. Thus it is apparent that the first essential is the standard we set.

As in the commercial development of anything of merit, the public must first be made familiar with what we have to sell



Signs at Cincinnati and Atlantic City (1600 4-c.p. lamps).

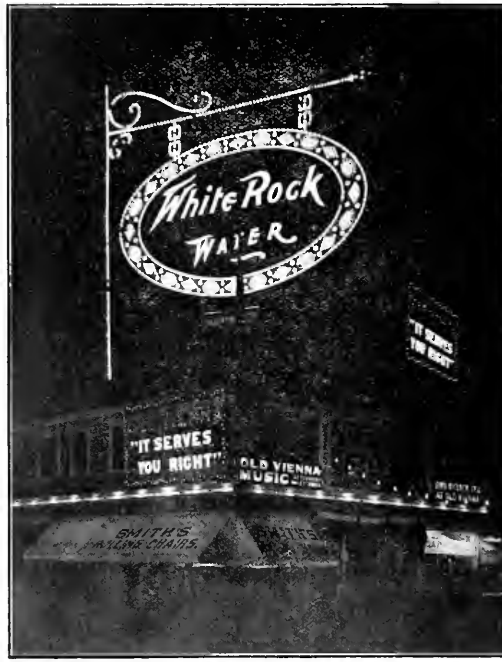
and know its advantages before a demand for the product can be expected. In the smaller cities this process of education may be quickly carried on with very small investment, but in the larger cities a campaign of newspaper and other printed advertising and publicity would be necessary if quick results are desired.

In this connection it is my opinion that there are no uniform or well defined methods to meet the requirements. A distinct campaign should be planned for each station to fit the character and conditions. Avoid the "quack-doctor" with the panacea of stock cuts. He who never sold electric service to the people is not apt to do so successfully by his pen.

The work of promoting the service should first enlist the support of every empoylee of the central station and every person in the community whose prosperity is affected by that of the station company. The interests of the central station are, in turn, linked closely with those of the municipality in which it is located, and to the extent of good will and harmonious relations between the people and the company will the company expand its service and the city its industries.

That community which retards the growth of its central station, retards its own, for the development of the electrical service in any city is conceded to be a prime factor to the city's development.

Now that the company is right internally, and has the am-

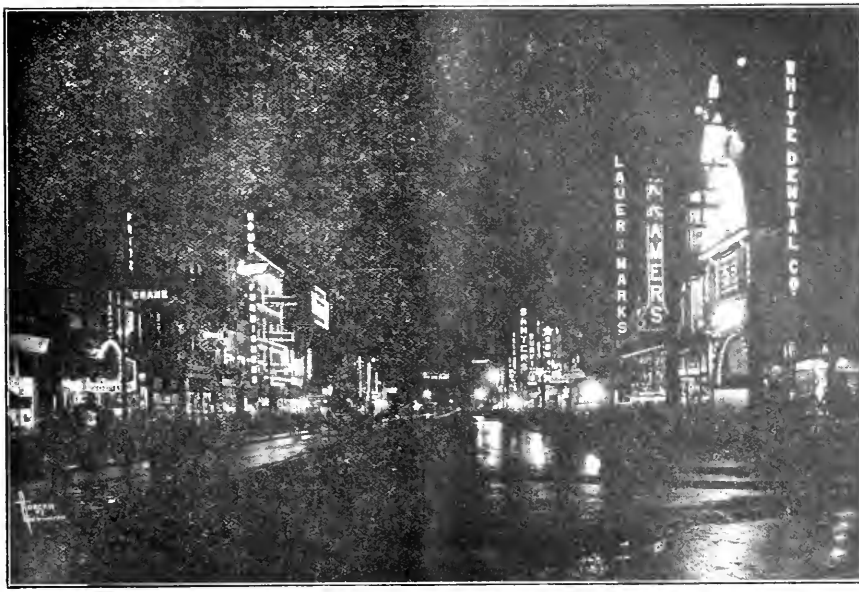


Electric Signs One at Atlantic City, one at Philadelphia, one at New York.

bition to progress, this is what it can set out to do, and what can be done.

1. It can popularize its service and make everybody want to use electricity wherever it can be applied.
2. It can turn all the industrial wheels.
3. It can illuminate every inhabited house that can afford any form of artificial illumination.
4. It can turn every business street into a nightly exposition and change a dismal unattractive town into a brilliant progressive one.
5. It can make the central station company the greatest medium of usefulness in the community—the leader of pro-

Example of Outlining at Lincoln, Nebraska.



Lackawanna Avenue, Scranton, Pa.

gression. It can do more to increase the growth of the city than any other institution.

The advent of electricity did more than place a new product on the market, it brought a substitute for every form of energy devised since the world began. It did not introduce transportation, it expanded the possibilities of transportation, likewise communication and illumination, and there lies in every conceivable industry, art, craft and form of commerce a variety of uses for electricity which require only information and demonstration to supply them from the central station source. We have access to the appliances and consumers' equipment; progressive manufacturers are constantly supplying new ones of improved efficiency. There is not a central station company that could not profitably maintain a modern salesroom in the highest rental retail district in the city to exploit electric appliances, nor a company too poor to afford a representative for every 10,000 inhabitants, or promote its business on the same broad plans used to market other commodities.

Monopolistic practice that does not conflict with the laws of the land should be forgotten and the business given a promotion that the greatest and grandest art and industry are entitled to.

Perhaps some may think that their particular conditions do not permit of sufficient appropriations to carry out the de-

A Unique Example of Street Lighting, Marion, Ohio.

velopment according to their ideal. Here are some of the essentials which cost little or nothing but are sure to bring station increase:

Public spiritedness, courteous treatment, anxiety to please customers, prompt execution of orders, a clean office, attractive show windows, office co-operation, enthusiasm in the work, the spirit of progress and a united effort to practice that keystone of all commerce—the Golden Rule. It was Henry L. Doherty, that leader of nearly every progressive movement in central station practice, conceded to have no peer as an authority upon public utility affairs in the world, and incidentally a member of this association, who issued requests to his army of employes throughout the central station and gas company offices, "See to it that every person who approaches you will go away a better friend to the company than when he came."

The "Masters of Success" in the English speaking world are paying the highest premiums for men and methods which will charge their institutions with this spirit, the fostering and cultivation of it will first permeate those working together and then it will conquer the whole city.

Many central station companies nave already found the character of patronage sought after and secured, to be a saving factor in their business. It has meant in some instances the difference between prosperity and bankruptcy. It has been proved beyond question that in no variation of climate, location or character of population is there any permanent obstruction toward improvement of load-factor. The problem is distinctively a commercial one. Some of the forms of patronage most easily developed are:—

Popular midnight or all night show windows, sign and decorative lighting.

Domestic and industrial heating and power appliances.

Industrial power which is contracted for "off-peak" hours.

Where legally permissible it is found that the Doherty rate—which equitably rewards the customer for long hour consumption by a decreasing rate of charging—is an effective method for improving the load factor, as the decrease of rate per unit does not increase the net profit but financially permits a new sphere of industrial business and liberal lighting.

The Electrical Age demands the specialization and analysis of everything pertaining to the industry. The details of organizing the selling opportunities, of adjusting the service, and of adding business, will all become easy enough to those who determine to secure results along these lines.

I will feel honored to contribute specific experience if a general discussion follows.

It may interest you to see here a series of stereopticon pictures which reproduce a variety of night scenes in American cities. This collection was recently exhibited at the Chicago Convention of the N. E. L. A.

I have outlined those which I consider the most vital methods towards increasing the station load, and trust they will serve in new fields as well as they have served elsewhere.

I desire to express my appreciation in the name of the National Electric Light Association for your many courtesies in this city, where I first saw electric light, and the land in which I first discovered the light of day.

Mr. William's paper was followed by a number of stereopticon views of electrical signs for use at night, and of outline lighting, which Mr. Williams explained. In the course of his remarks Mr. Williams said: Several years ago we had the idea that the possibilities of decorative lighting were limited, due to the restrictions of certain city ordinances, which prohibited signs from being placed over the street line. I think you will find that these ordinances will in time prevail all over the country. We had to resort to substituting decorative lighting around the cornices of buildings to use out the contract for the sign; it grew from that into a regular development of outline lighting. In a good many towns the business of outline lighting is promoted just the same as for sign lighting. In several cities no signs are allowed to extend over the sidewalk unless lamped, and creditable signs to the city. In promoting this kind of lighting the success of it will depend very much on the design of the first examples erected. The largest piece of outline lighting in the United States is on the departmental store of Mabley & Carew at Cincinnati, Ohio. They spend annually $80,000 for advertising. The lighting part of it costs them between eight and ten thousand dollars a year, and they say it is the cheapest advertising they have. The development of decorative lighting has been projected I think a little longer in Denver than in any other American city, and naturally they are beginning to reap the benefits of it, I think, more than any other city in the country. They have a large income from signs at Memphis. Their revenue per kilowatt at the station from electrical signs is $138. If I were called on to advise in this matter I would advise central stations not to get into the idea of putting signs across the street, because as the city grows somebody will want to take them down. In the development of the sign business a great factor is the variety of signs. I could not help but admire the signs in Toronto, and I predict that Toronto will be a wonderfully well-illuminated city in a few years by the way they are going on with it, by the extent and character of the signs in use.

Discussion on Mr. Williams' Paper.

The discussion which followed Mr. Williams' paper brought out a number of interesting points. In answer to Mr. Dion, Mr. Williams said that the outline, sign and window lighting which he had pictured were generally sold on a flat rate basis. In a few places where meters were used they were simply a protection against theft. Hours of lighting were generally specified in the contract, as from dusk until midnight, and ranged from 2,000 to 2,200 hours per year. They would be computed as follows: A 20-watt lamp would be multiplied by the rate per kilowatt, by the number of hours per year, this divided by twelve would give the price per month. The signs were turned off and on by the company at a small expense compared with the revenue derived. Renewals of lamps were generally considered in making the rate per lamp or per kilowatt. If the current were, say, eight cents per kilowatt, possibly the estimating of the cost of renewing lights would be on the kilowatt basis or yearly basis. In a good many cities now, a specific rate was made for a four c.p. lamp per year. This was a convenient form for quoting the rate for national electrical advertising. This method did not include the colored lamp.

In reply to the President, Mr. Williams said experience showed that once a man used such a sign he became an almost perpetual user of it, so they seldom tried to tie a man up on more than a year's contract. However, they never took anything less than a year on account of figuring the monthly flat rate. A great many companies took this business on three, four and five year contracts. The largest one he had illustrated, containing something like 7,000 lamps, was on a three-year contract. In some plants exceptionally large decorative features were being taken off the peak, the customer possibly being given a concession for the privilege.

In answer to Mr. Grant, regarding the best method of campaigning for customers of this class, Mr. Williams said it was essential that soliciation be used in some way. The exact method was difficult to explain. After an experience extending over twenty-five cities he had found invariably that they had to get a sort of co-operative spirit going in the town before they could do very much with it. They would have to show the merchants as a body the advantages of display lighting. It was broadly conceded now that business would follow the well-lighted city. In most places they had used newspaper advertising to help the movement. Once a few large installations were obtained, others and larger ones would soon follow. If there were five drug stores in a town, one of which installed a beautiful display, it would be a little easier to get the other four, and by the time three of them were obtained the other two were practically certain.

Replying to Mr. A. E. Fleming regarding the necessity of cutting a special rate in order to introduce the signs, for instance a 10-cent rate, so as to form a flat rate basis, Mr. Williams thought this would not be necessary on a 10-cent rate. Nearly all the cities he had referred to had a sliding form of rates with a premium for the long hour user. In a town of 25,000, if the merchants put up 20,000 4-c.p. lamps to burn until twelve o'clock at night, the net profits would be greater on a 5 per cent. per kilowatt basis than for an average patronage at 10 cents. In the cities he had referred to they had the Doherty rate. In places where there was no sliding scale and the basis was 10 cents per kilowatt, advertising business would probably

Electrical News Gal 8 ....

be taken profitably on a six or seven-cent basis. The gross revenue from the signs he had shown in the Atlantic Sity pictures, ran into a small fortune every season They were taken on a 12 cent rate for summer season service and on an 8-cent rate for the year round service. Many of the users had recently commenced to take advantage of the low rate for the year round.

President Kelsch, instanced a case where a company started in the sign business by giving every other drug store on the main street a fairly low rate on condition that they distribute literature published by the lighting company. In a short time the other drug stores applied for signs. As soon as they had the drug stores in line they started out with another line of business, and as fast as the man in the shoe store or grocery store saw his neighbor or competitior with an electrical sign

he had to have one too. That, he thought, was the method pursued by most of the successful companies.

Decorative Lighting in Toledo.

Mr. McKay said that in Toledo he had the same experience and found that decorative lighting was very apt to sell itself. Six months ago they had put in operation on Summit street some 156 liminous arc lamps, two lights to a pole, and poles about eighty feet apart on each side of the street. A month later merchants on other streets were fighting to see who could get the same service earliest. Since then the city had ordered 250 additional of these lights. Probably in the next year and a half every business house in that city would be illuminated on a uniform harmonious scale, which would be profitable to the company. The same thing applied to the sign lighting for which his company gave lower figures than any he had heard mentioned at the convention, in fact, all this company's figures were lower than those of other companies because they had to meet natural gas competition, which was sold at 35 cents a thousand to the average consumer. There was also a natural gas plant in his city to compete with, yet they found a field for every product they had to sell. Their power business was increasing steadily and so was their electric light business. During the financial depression their electric light and power, and the gas businesses had gone ahead while the street railway business had suffered heavily.

Mr. Williams endorsed the point Mr. McKay made that during the recent business depression the electric lighting business had suffered less than the traction business. He attributed this to the merit of the sign itself, and to the fact that they were continually after the merchants to put up more signs. He knew something of the obstacles encountered in a city such as Toledo, where Mr. McKay's company was operating, through the competition of natural gas. Many of the people would be inclined to take advantage of the cheap rate for natural gas. He attributed the good and extensive service at Toledo simply to the company's progressiveness.

President Kelsch said that though Montreal was the largest city in the Dominion, he believed it was the most backward in respect to sign lighting. This was probably due to an ordinance of a good many years' standing, which prohibited a sign from projecting more than thirty inches from the building. He believed they were making an effort to have that ordinance cancelled or modified. In spite of everything, however, Montreal, he thought, had done more in the way of sign lighting in the past ten months, than in the previous ten years. There were some very large signs in operation now, and others going up daily. Like every other city, Montreal simply needed a start.

In reply to Mr. Ryerson, Mr. Williams said the men who went after new sign or decorative business should be paid a small fixed salary plus a commission, based on the class of business obtained, rather than the bulk of it. Outside of this method the most satisfactory would be a straight salary according to ability. The ideal salesman was one who had some technical education concerning electrical service. In places where he could not obtain experienced men he would take one experienced man with him and in a town of 30,000 people would hire two or three men locally. Very often an unsuccessful salesman of other products would turn around and be a star in electrical solicitation. He himself, he said, had been something of a fizzle in selling anything else, until he encountered the gas and electric business. As to newspaper advertising, the amount which should be spent on it varied greatly with local conditions. He preferred not to answer Mr. Ryerson's question regrading this point, because, if he named a figure, he thought they would all be astounded.

President Kelsch in concluding the discussion, referred to a company which he knew of, which paid their solicitors for sign work, a fixed salary. They were engaged for sign work alone, and in addition to the fixed salary were given a percentage of the first month's revenue from the signs.

The Woodstock, Ont., council will shortly have to renew its contract with the Bell Telephone Company. There is a general belief that the company may agree to install a central energy system.

The Farmers' Telephone Line of Woodstock, N. B. is being extended around the village and it is the company's intention to put in a local exchange. The rates are only $10 per year. The company also intend to run their line to Lansdowne, and probably to Woodstock, this year. The line already touches Windsor (the head office of the company), Lower Windsor, Armond, Coldstream, Hartland and other points, and has nearly a hundred subscribers.

Lost and Unaccounted for Current

Paper read before the C. E. A. annual convention by C. R. McKay, Toledo.

The importance of this topic as affecting the ratio of earnings to operating expense has long been recognized, and exhaustive investigations and reports have been published by able engineers in the technical journals and proceedings of various electric lighting associations in the United States.

This paper does not claim to present anything new or original, but perhaps will serve a useful purpose in maintaining a live interest on the part of smaller companies in a topic which should ever be of vital interest to their managers.

The operating engineers of large companies are generally wide-awake to the necessity of tracing out and reducing all generating, converting and distribution losses, and the meter and contract departments of these companies have from long experience and continued efforts accomplished excellent results towards insuring the accuracy and efficiency of consumers' meters, and in reducing improper or illegal waste and usage of current.

Among smaller companies, or those operating electric systems involving scattered distributions and numerous transformations, and where the investigation of these losses is limited by financial conditions or lack of enterprise, the income represented by lost and unaccounted for current may frequently determine the ability or inability to pay dividends.

"Lost" and "Unaccounted for" current are two entirely distinct items, and should be so considered, although both unite to compose the serious discrepancy between the monthly station output and the monthly registration of consumers' meters.

The "Lost" component is that energy which is wasted in heat, due to conductor resistances, iron losses, machine friction and windage, and incomplete or irreversible chemical reactions which may be inherent to the system of transmission and conversion in use. It includes copper losses of meters and instruments, regulators, feeders and mains, sub-station apparatus and transformers, which losses vary in amount with the continually varying current. It includes iron losses in regulators, transformers, and sub-station machinery, which vary but slightly with the load. It also includes losses in sub station storage batteries, switchboards and controlling devices.

The "Unaccounted for" component is that energy which may escape registration through consumers' meters, due either to meter defects, grounds, line leakage, unmetered current sold on flat rates, emergency or temporary connections, stolen current and metered consumption not recorded on the books of the company.

The aggregate percentage of "lost and unaccounted for current" in any given instance will depend largely upon the nature of the electrical distribution system in use, as well as upon the efficiency and diligence of the operating and billing departments of the company, and for this reason, although considerable data has been obtained and published showing the extent of such losses in certain cases, such data cannot be applied directly to other properties with any degree of accuracy. It is, however, of great value as indicating the great savings often rendered possible by a careful study of the individual causes of loss, the means of finding them, and the remedies to be applied.

Briefly, it may be stated that to secure the desired results requires more business ability and system than technical ability or expense, and therefore this question should interest the property management at least as much as the engineering department. This fact, however, is not always recognized.

The energy loss due to the resistance of any circuit is readily found when the current does not vary and the load is concentrated at one point, but this condition rarely exists in central station distributions. Instead, we must determine the ohmic resistance and the curve of current variation, section by section, over the system and throughout such time as would be represented by the losses.

Thus, an average daily load curve may be established for a given feeder, or section, for each month of the year, and with occasional corrections or check tests to cover the shifting or variation of load, such curves may show good accuracy for considerable periods.

In any circuit the copper loss in watt hours for any period is the product of the circuit resistance and the mean square of the current curve.

Large errors may result from the square of the average current instead of the mean square thereof; thus assume that a

circuit of one ohm. resistance carries for three successive hours, respectively, 4 amperes, 6 amperes and 2 amperes. The average current is then 4 amperes.

The average current squared is 16 amperes. And 16 amps. x 1 ohm. x 3 hrs. = 48 watt hours, loss, which is incorrect.

The actual loss is as follows:

	Amperes.	Amperes Squared.	Ohms.	Watt Hrs. Lost.
1st hour	4	16	1	16
2nd hour	6	36	1	36
3rd hour	2	4	1	4
Totals	12	56		56
Mean	4	18.67	1	

Thus the actual loss is 56 watt hours instead of 48 watt hours, an excess of 17 per cent., as is evident from the following:

The mean square of the current for the 3 hrs. = 18.67 amps.

Whence 18.67 amps x 1ohm. x 3 hrs. = 56 watt hrs.

Line losses as well as regulation may be much affected by the disposition of the copper in feeder, mains, or secondary lines.

It is preferable to proportion the loss high in the feeders and low in the mains or secondary lines, unless the feeder itself performs the function of a main, with the load distributed throughout its length, as frequently occurs with small plants.

Feeder loss, between bus bars and distribution centre, is most conveniently found by installing recording wattmeters at each end of the feeder, the difference in their readings representing this loss if no line leakage exists and no current is taken off between the wattmeters.

Satisfactory results may be obtained by the use of ammeters and voltmeters, either of the indicating or curve tracing types, but at the expense of considerable time and calculation.

Where a line supplies a distributed load, the copper losses can at best be merely approximated, the methods, however, being the same as for obtaining feeder losses, but the losses must be separately determined for short sections of the line. The degree of accuracy in this case evidently increases as the sections are made smaller.

Copper losses in transformers are obtained either from the average resistance measurements of numerous transformers of each size, and applying these averages in the calculations for the district, or the transformer resistances may be obtained from the makers and used in the calculation, or the individual transformers may be actually tested in place on the line, which is preferable from the standpoint of accuracy, but will involve practical difficulties of the primary voltages which must be handled.

Instruments and meter resistance losses are determined from average measurements made at the meter room.

The iron losses in electrical distribution occur chiefly in transformers, and become especially prominent where the consumers are so scattered as to require individual small size transformers. This is the most prolific source of energy losses occurring in small alternating current plants, and the not unusual discrepancy of 40 per cent. occurring in such plants between the station bus bar and the consumers' meters is chiefly due to this cause.

Alternating plants of small load factor supplying day circuits with house to house transformers, suffer greatly from these losses, and the expenditure of considerable sums of secondary line copper and the substitution of larger and fewer transformers will in such cases be well warranted.

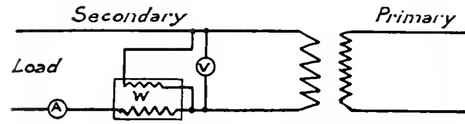
Considering three transformers of respectively 1 kw., 10 kw. and 50 kw. capacity, the following characteristics indicate their relative economic values:

Relative Characteristics—60 Cycle Transformers.

	1 Kw.	10 Kw.	50 Kw.
Relative cost	1.	4.	14.6
Relative weight	1.	6.2	17.3
Relative core loss	1.	4.1	10.6
Relative regulation	1.	0.53	0.42
Relative effiency ¼ load	1.	1.07	1.09
Relative effiency full load	1.	1.03	1.04

The iron losses of a transformer or a regulator may be readily measured by the wattmeter method, running the transformer or regulator on open circuit at the normal circuit voltage, at the same time measuring the exciting current. The instruments required are a voltmeter, an ammeter, and an indicating watt meter, each suitably chosen as to its capacity and designed for alternating current.

The connections are thus:



The wattmeter indicates the iron losses under the given conditions, the copper loss due to the exciting current being assumed negligible in comparison, as it generally is in fact.

For safety and convenience the transformers are generally excited and tested on the low tension side, and this procedure may be followed out with the transformers actually in place on the line, provided they are connected to a secondary network which will furnish the exciting current when the primary cut-outs are removed.

Transformers should be carefully selected for the primary voltage and frequency at which they are to operate, since the iron losses may materially increase at higher voltages or lower frequencies than the normal.

Sub-station losses include both copper and iron losses in the operating machinery, switching appliances and conductors, and in some cases storage battery losses.

Little can be done to reduce machinery losses in a sub-station when once permanently equipped, and their segregation is therefore rarely undertaken in practice. Storage battery losses, however, should be determind, as they may readily be considerable and exert important bearing on the physical condition and life of the battery.

The aggregate sub-station loss, as an item in the total distribution loss, may be obtained directly from the difference between the input and output meters now commonly furnished with all modern switchboards. In sub-stations on interconnecting systems or networks, the direction of energy flow and therefore the meter registration may frequently reverse either by accident or intention. Provision should be made in such cases to separately meter the energy flow in each direction.

Few plants neglect the taking of station load curves, but the number where feeder load curves are regularly kept is relatively few, doubtless because of the additional burden thrown upon busy switchboard operators, where numerous indicating instruments would require frequent readings.

For a plant which has attained considerable size, the use of curve tracing instruments in obtaining load curves is a practical necessity, and in no other way can equal accuracy be obtained with so little labor and expense. Any necessary investment in a suitable equipment of such instruments will generally pay for itself in a few months.

Much has been said on the subject of slow meters and a common statement places the average percentage of unaccounted for current due to this cause at from 2 to 3 per cent. Probably this is an under-estimate of the facts, if applied broadly to any considerable number of electric lighting stations, and that figure undoubtedly represents about the best obtainable result in practice.

It is not uncommon to supply energy to temporary consumers without installing meters, this being particularly the case with small plants, and not infrequently electric signs and display lighting are likewise operated without meters and charged for on flat rates. In the aggregate this practice may add considerably to the percentage of unaccounted for current.

Another prolific source of such loss may be due to stolen current, or to consumers not of record on the company's books. Current theft is both extensive and puzzling to deal with. The means and devices adopted to commit such thefts are almost innumerable and difficult to detect. Apparently no class of society is free from such offences, although they most frequently occur in places of established disrepute.

Many states have passed legislation making this offence a crime punishable by fine or imprisonment, or both, but the prosecution of such cases is not only a difficult and expensive matter but frequently involves such subsequent sacrifices of powerful interests as to render questionable a general policy of prosecution. Probably on the whole it is preferable to use other means of preventing or stopping such offences, at the same time using the utmost vigilance in their detection.

In the recent case of one rather extensive property investigation developed approximately twenty-five instances where important residence and mercantile consumers had been using current through meters for many months with no record thereof in the billing department. The valuation of their unaccounted for current aggregated many hundreds of dollars, much of which had become uncollectable.

Doubtless every large company supplies a greater or less number of unknown consumers, and this can only be avoided by maintaining the closest relation between the line department, the meter department and the billing department.

No consumer should be connected to the system without promptly transmitting to the billing department a written record thereof.

Losses from line leakage are not generally serious, due largely to the fact that the physical effects of line leakage generally manifest themselves so promtly and unmistakably as to insure prompt remedy.

Before the President introduced the discussion upon this paper, Mr. McKay said that with reference to the statement that it was preferable to proportion the loss high in the feeders and low in the mains or secondary lines, even then very unsatisfactory results in determining line losses by meters might be obtained, because if the line loss were very small or the load very light, the difference between the watt meter readings might be less than the percentage of error of the watt meters themselves. So it was necessary in this as in other cases, to adapt the means to the conditions within certain limits. On the question of iron losses, in looking over a plant for a party a short time ago, he found the actual lost and unaccounted for current was something in excess of 55 per cent.

Discussion on Mr. McKay's Paper.

President Kelsch in opening the discussion said that the charter of the Montreal Light, Heat & Power Company entitled them, if they caught anyone stealing current, to fine him $100, without trial. They made it a rule to give the inspector one-half of all fines. This had resulted in the detection of several persons stealing current, through shunting the meter or having no meter, or in various other ways. This company had a service order which must be checked by every department before it could be filled, so that very few customers could get away. The power to fine people for theft which this company possessed was independent of the Act under which they did business. They had fined several people $100 for this offense, and as a general rule the party caught, was willing to pay the fine and call it square.

Mr. Dion said that in his experience, the law making it a criminal offence to steal current was of no use to the companies because it was practically impossible in most cases to make a case before a criminal court. This was probably the reason why the Montreal company had adopted the method referred to. With his company there was no settled rule about the matter as yet. They treated each case on its merits and in many cases had obtained money compensation from the parties who were detected. If they could bring cases into the police court and get a conviction it would have a deterent effect on others, but it was better not to attempt this unless they were sure of succeeding, as it would be fatal to bring a case into court and not prove it.

President Kelsch said that Mr. Dion's remarks brought up the subject of what a committee could do between conventions. The object of Mr. McKay's paper had been to show the lost and unaccounted for current, by poor efficiency rather than by theft. He had referred to iron loss in transformers. He, Mr. Kelsch, knew of an instance a short time ago where 35 old transformers were taken off a circuit and ten new transformers replaced them. The change was made in one day, and the station attendant thought the circuit was open the next day; there was no load on that line.

The telephone system at Moyie, B. C. will be installed shortly. At a recent meeting it was decided to have the work done at once by day work, not by contract. All the material is ready.

The assets of the Berlin District Steam Company, Limited are to be disposed of by tender. Osler Wade, Toronto, is the liquidator and will receive tenders up to August 12th. The assets consist of a plant for producing and distributing heat and power and for producing light.

For the first time in history the Queen Charlotte Islands possess a telephone. The enterprising Japanese at the Ikeda Awaya mine have completed an installation which connects Ikeda Bay with the hotel at Jedway, the total length of line being in the neighborhood of four miles.

I. Fournier, a lineman in the employ of the Hull Electric Company, was electrocuted while operating the switchboard at the company's office, Main street, Hull, Que. Just how he met his death is unknown, as the wires were all dead ones, but it is thought that he had reached up and come in contact with the wires above. Life was extinct in a few minutes. Deceased was a young man about 28 years of age and unmarried, and was living with his parents.

The National Electrical Code

Paper read before C. E. A. Convention by H. F. Strickland, Chief Electrical Inspector Canadian Fire Underwriters' Association.

In introducing this subject I think it would be very appropriate to explain to some who are not thoroughly familiar therewith, some of the details pertaining to the making of the Code. It is a prevailing impression that the National Code is a sort of dogma, which has been manufactured entirely by people who are interested only in the protection of their property against fire, and that the insurance companies have constructed this book, known as "The National Electrical Code," from their standpoint.

The National Electrical Code was originally drawn in 1897, as the result of the united efforts of the various insurance, electrical, architectural and allied interests which, through the National Conference on Standard Electrical Rules, composed of delegates from various National Associations, unanimously voted to recommend it to their respective associations for approval or adoption, and is now presented by the National Board of Fire Underwriters with the various amendments and additions which have been made since that time by them.

As an evidence of the approval of the National Electrical Code, it might be interesting for those present to know that the following institutions compose the National Conference on Electrical Standards, viz.:

American Institute of Architects.
American Institute of Electrical Engineers.
American Society of Mechanical Engineers.
American Institute of Mining Engineers.
American Street and Interurban Railway Association.
Associated Factory Mutual Fire Insurance Companies.
Association of Edison Illuminating Companies.
International Association of Municipal Electricians.
National Board of Fire Underwriters.
National Electric Light Association.
National Electrical Contractors' Association.
National Electrical Inspectors' Association.
Underwriters' National Electric Association.

As a further evidence of the broadness of the National Electrical Code, it would be interesting for many people to know that the amendments which are generally conceded to be advantageous in the Code are made at annual conventions held yearly in New York City. I have had the good fortune to be present at the last three of these conventions, and a few words in reference to the manner in which it is conducted might be interesting.

Some little time previous to each annual convention circulars are sent to the various members calling for suggestions as to proposed changes in the Code at the coming convention. These changes are received by the secretary of the Underwriters' Association and are submitted to an Electrical Committee, who carefully consider each suggestion received. If the suggestion does not warrant any consideration, it is thus reported at the convention. If, on the other hand, they see any value in the suggestion, it is reported also for consideration. Each suggestion, whether approved by the Electrical Committee or not, is nevertheless mentioned on the proceedings of the convention, and those which have not been fully considered by the committee may even then be discussed by those present if anyone brings the question up. As a rule, however, those suggestions which have not been considered worthy of thought by the Electrical Committee do not call forth any further discussion. In this way much time is saved and only valuable suggestions are considered. Now, if those present were only those directly interested in the insurance end of it, the rules might become ecclesiastical and one-sided in their nature, whereas each question which is brought up is subjected to criticism from all sides. The meeting is open to all people directly and indirectly interested in electrical work, and all manufacturers and representatives from the various allied interests have an equal voice in the discussion which takes place before any rule is altered or in any way amended. The debates are, therefore, at times very interesting, and every rule which has been adopted or amended has been done so owing to the approval of the manufacturers, inspectors and the consumers. The National Electric Light Association and representatives from the Contractors' Association are always present to look after the interests of their end of the business, so that it is impossible to railroad a rule into the Code without all interests being thoroughly

acquainted with the nature of the rule and until it has met the view of the majority of those present.

As a result of the foregoing outline illustrating the formation of the National Electrical Code, we, the Underwriters' inspectors, point with pride to the little book and feel that we have one of the fairest and most complete works that is to be found in any country; in fact, I do not know that such a thing exists anywhere else except on this continent.

Enforcing the Code.

Passing, therefore, from the making of the Code to the enforcing of it, we get up against the real thing. It might seem to many people, and does I know strike some people, that it is only necessary for the Underwriters' Inspector to enter a building and say this job is not according to the Code and will not do, and with that quietly retire from the scene of action. Possibly an inspector could do his business this way if he was absolutely indifferent to people's feelings, and was either unable or unwilling to consider the pros and cons in question and ultimately the interest of the Underwriters themselves. Such action on the part of an inspector would create an intense resentment on the part of the electrical interests, and I am quite sure he would very soon lose the co-operation of the said interests, which are so essential in maintaining a standard as far as possible in keeping with the intention and spirit of the Code. I think the intention and spirit of anything is always better than the cold hard legal fulfilment thereof. I may be mistaken, but that is my policy, and I am quite sure from what I have heard from reputable contractors and others that it is the most approved way of looking at the question.

In enforcing rules in the Code we have two or three distinct classes of people to deal with. There is, first of all, the man who knows how and knows he knows it, and would not for a moment allow defective work to go unremedied under any consideration, and there are one or two firms in this city who penalize their employes by causing them to remedy defects, after hours, on their own time, one firm going so far as to have his employe call and see the inspector and explain in the best way he can how he came to make the mistake. Now, in dealing with a firm of this nature, whose motto is good work, it would be very foolish, ungrateful and short sighted to merely turn on the heel and have nothing further to say for any deviation from the strict letter of the law. It is in everyone's interest to thoroughly consider all points before rejecting work which has been installed by people of this description, and it is furthermore decidedly politic to submit their errors to them in a considerate and reasonable manner.

Taking the next class of contractors, which is unfortunately considerably more numerous, is the one who thinks he knows all about it, advertises largely to this effect, and possibly may know something about it, but employs cheap labor and always blames mistakes on his employes. With this class of man who may be and often is polite, and to a certain extent what is known as a "jollier," we have to keep him pretty well chased around, I might say, in a becoming jolly manner.

Then we have the out and out "know it all no nothing schemer," of which class I regret to say the community is in most places very well supplied. In dealing with people of this no return is forthcoming no matter how considerate or polite description politeness and consideration are entirely wasted and one may be in dealing with them. They take work at little or nothing and trust entirely upon cheap labor and every known subterfuge to evade the rules. Still while entering into contracts with their customers they are very profuse in their promises and enlarge extensively on having the highest recommendation from the Underwriters' knowing as a rule that their customers will not refer to us, as they generally accept their statements as gospel truth.

We then pass on to the fourth class of wireman, which is one of the most pitiable and tiresome class we have to deal with. This is the man who does not know, hasn't the money to do it right, and may have fairly good intentions, but invariably is in trouble and makes the same excuse, that he did not get enough money to do the job right. Sometimes these fellows deserve more than they get; on the other hand, one cannot help sometimes feeling sorry when he is obliged to refuse to accept their work.

You can therefore see that an inspector has an assortment to deal with, which you may see requires special handling in order to get the best all-round results obtainable.

The foregoing outline will, I hope, to some extent throw a little light on the surroundings in connection with the making and enforcing of the National Code.

Passing on, then, from this stage I will touch on a point which was mentioned to me not very long ago by a member of the Electrical Association, which was to refer in my paper to some of the changes which I, as inspector of this district, have made in the Code in connection with the work in this territory.

Outside Service Pipes and Meter Boards.

In looking over our bulletins and surveying other requirements generally, I really cannot see that there are any requirements in any of my interpretations which are in any way beyond the Code, or even in some instances as strict an interpretation as might be abstracted therefrom. The only points which could in any sense be regarded as local requirements are the outside service pipe and the introduction of meter boards. These are unquestionably necessary rulings, and while not specially mentioned in the Code as compulsory, they are a very wise and popular requirement. The meter board is merely a matter of finishing the job and is fully explained in our No. 12 Bulletin, copies of which can be obtained for the asking, and which have already been distributed in large numbers throughout the various supply houses and to contractors in the city. I feel that the expressions, together with the illustrations shown on this bulletin, require no further enlarging upon.

The question of the outside service pipe has a two-fold object, one being that the overhead service is dispensed with, thereby removing objectionable cut-outs, switches and meters from behind curtains and the tramping of meter readers through people's private bedrooms, often in the morning before they are up, to say nothing of the unsightliness thereof, and on the other hand it brings all the wiring down to the basement, so that the meter can be installed in a convenient place to read and is always ready to connect to an underground service at any later date. Outside of these two points I should be very plased to discuss any further suggestions in our bulletins, which are claimed to be beyond the contention of the Code. In the meantime, I will proceed with other points and quote my justification from the Code for so doing. I will, therefore, take up the question of motor enclosures.

Metallic Enclosures.

I have heard it frequently stated that there was no authority in the Code for calling for metallic enclosures. As a contradiction to this I will direct my hearers to Clause "f," Rule No. 8. This clause states distinctly that if deemed necessary the motor must be enclosed in an approved case. In reading the fine print note which enlarges on this rule, the last clause states that from the nature of the question the decision as to details of construction must be left to the Inspection Department having jurisdiction to determine in each instance. I, therefore, think that it is up to me in this case to decide upon the manner in which this enclosure is to be constructed. Taking all things into consideration, I do not believe that there is anything more generally satisfactory than the type of enclosure which I have called for in this city. This enclosure is ventilated, is readily accessible, oil-tight and fireproof, so that I fail to see where it can be improved upon. We of course would not call for an enclosure of this description with an induction or iron-clad completely enclosed motor, nor would I call for it where a motor was located in perfectly fireproof rooms and where there was no collection of rubbish or dust. It is a question where a little horse sense is required, and if I haven't any ordinary sense I hope at least that I have some horse sense.

Reinforced Cord.

Another most important point and one which no doubt is in the minds of those present, is the interpretation on the use of reinforced cord. According to the National Code the use of reinforced cord is compulsory in all places other than where it is short enough to hang freely in the air and cannot be hung over nails, pipes or machinery. In order for cord to be long enough so that it may be subjected to this treatment, it need not be very long, and even were it originally installed so that it would hang straight down some three or four feet from the ceiling it is quite long enough and invariably is hung on nails and subjected to various classes of injury with which we are all so familiar. On the other hand, in figuring on work or even where the engineer is specifying work, one man's idea may be that a three foot cord is satisfactory for ordinary cord, whereas another man may think that it is not, so that in relying upon the Code interpretation the engineer, contractor or other parties interested after all must rely upon the interpretation of the Inspector, which, if he were one of the arbitrary type of gentleman previously referred to, might easily rule out flexible cord on the ground that it might not always hang freely in the air. It therefore behooves us to interpret the rule so that there cannot be any doubt upon what is expected and required. I, therefore, submitted the question to all the contractors and supply dealers interested, and with only one or two exceptions,

one of which was a well-known supply house, who in some way or another overlooked the question, I really had but one unfavorable reply to the question as to whether the rule should go into force or not. On June 1 this rule became operative, and we are now busily engaged in seeing that it is enforced. I firmly believe that the uniform interpretation of this rule will be ultimately beneficial, and I am further convinced that there is far too much liberty and license in the use of flexible cord under all conditions.

The Proper Kinds of Wire.

We will next take up the question of wire. My interpretation of the Code is that all inside wiring with one exception should be approved rubber covered wire, the one exception being that in very dry or inflammable locations slow burning wire should be used. This of course must not in any way be construed to affect in any way the use of paper cable, which has its own special use. The use of ordinary weatherproof wire has no excuse inside any structure, unless it be for electric bells or work of a similar nature. In taking up these questions of specialties, I do not think it is well to pass over the requirement on condulets. I have had it said that we should not specify any particular make of fitting, as it would consequently tend to increase the sale for any one particular maker. This contention is perfectly justifiable and we would not undertake to call for anything which would create a monopoly. In all our ruling on condulets we have always stated that fittings in the form of condulets or equally satisfactory devices could be used. I must say frankly, however, that at the time this Bulletin was issued I had not seen anyth'ng that was in the same class with these fittings, and the object in calling for them was that in all cases where wires issue from the open ends of conduit they should be installed. Before the introduction of these devices wires were allowed to issue from conduits, often being very hard pressed on the edge of the bushing, which when found in very dry or dirty locations was regarded as a fire hazard and is, I am convinced, a fire hazard; in fact, I know of at least one fire which has been caused by this defect since I have been Inspector. It is, therefore, better from every point of view as well as from an artistic viewpoint to have the wires brought out from conduits through fittings of this nature, and I am most gratified in being able to state that I have had less trouble in having this idea adopted, although there is as a matter of fact no specific demand in the Code for its use. The value of this fitting was so approved that it did not require a great deal of energy in having it readily adopted by both the consumer and the contractor, and there is hardly a proposition that they will not readily take care of if the worker understands their use. I have heard it stated also that supply dealers and contractors were at a loss to know why I would not pass various forms of English tumbler switches. For the edification of the trade at large I might say that it is only during the last few weeks that I have ever had the question of tumbler switches brought to my notice. I only obtained samples of these switches by asking for them, and outside of this one instance I have never had samples of English tumbler switches submitted to me by supply dealers in Canada or United States. Be it said, however, and understood that personally I think the English tumbler switch is an extremely nice and desirable switch in every respect, and that where they are constructed with the insulated roller and the fibre lined cover, they will be passed as any other switch, none of which I prefer any more than an approved push flush switch, which for concealed work is, I believe, a peer of them all.

Transformers Inside Buildings.

I think the next point of importance is the use of transformers inside the walls of any building of any description. This is a point upon which I have "got up against" even the consulting engineer, and because I refused to pass a large risk where transformers had been installed inside the building the ruling was considered as a lot of nonsense, and that such a thing as danger or loss of fire from this cause was problematical. It might, therefore, be interesting to consulting engineers generally to know that even if it is problematical, nonsensical, or any other adjective which could be satisfactorily applied, the Underwriters do not want transformers inside their risk, and I am prepared to state that the Factory Mutual Insurance Companies regard this matter in exactly the same way as we do. I can hear some people saying, "Why?" I emphasize the word "some" because I am quite sure the "some" is a small one. Nevertheless, it is very apparent to any one that a boiled over transformer which has become ignited and which is very likely to become ignited under those conditions could do an enormous amount of damage in some risks. We do not have to depend entirely upon flame and combustion to constitute heavy fire losses, in fact it is generally smoke and water which most largely contributes to all fire losses. It is true that the number of losses from boiled over transformers is not great, but the fact that such a thing can occur is all the evidence that is necessary to warrant us in being on the safe side; in other words, "it is better to be sure than sorry." Where it is necessary owing to every other resource having become exhausted to place transformers inside the building, they should be located only in cement, brick or other absolutely fireproof enclosure located on the ground only, so that they can be readily drained and conveniently ventilated. These enclosures should be accessible only from the outside, that is to say, that the entrance door for opening should open to the outside air only, so that the transformer could boil over and catch fire and no smoke or burning oil could enter the building. This is a first class arrangement according to our way of looking at it.

Induction Motors.

Passing on from transformers to induction motors, I think it is worth while mentioning my belief that the most satisfactory method of installing a starting and controlling apparatus in connection therewith is to install them entirely in a fireproof cabinet, that is to say, that the auto starter, fuses and switch should be in a fireproof cabinet. I do not think there is anything better in this case than a galvanized iron one, constructed of heavily riveted iron with a spring catch, and referring to the question of heavily riveted iron with a spring catch, and referring to the question of switch, I think that every individual motor in an installation should have a knife switch independent of the auto starter, and that they should be fused on both sides of the starter. In this and all other cases where motors are under consideration, either direct or alternating, I believe that the starting and controlling apparatus should always be enclosed in fireproof cabinets. No matter how perfect the switches and fuse holders may be they will always be subjected to rough usage, exposure to mechanical injury and a substitution of fuse wire where cartridge fuses are intended to go. This is also in line with the National Code, where enclosures are referred to under Rule No. 8, section "d."

I do not know of any other points in connection with the local interpretation of the National Code which can in any way be constructed as being personal or in any way distinct from the intention and rulings of the National Code. There is a point, however, with which the Inspector is frequently confronted, and that is, that in some individual cases well-established and long-enforced rules may appear quite unnecessary. It is only during the last few weeks that I was called upon to make final inspection upon a large installation. This installation was fed from overhead wires run down from the pole in conduit into an underground vault and from thence into the building in tile duct. At the pole, which was some two hundred feet from the building, there had been provided a wooden box with fuses to protect the entire installation. Immediately at the point of entrance to the building in the basement, the cables entered an iron conduit and were conveyed from there a great distance through the building to the switchboard. Under Rule No. 22 "a" I called for main line switch and fuses at this point, that is to say, at the point where the underground wires entered the building and commenced the long run in conduit. There was more or less conflicting opinion on my ruling of this question, and I believe it to be of sufficient importance to serve as an illustration as to the why and wherefore of some of the Code interpretations. The point at issue was that these wires were already fused out on the street at the pole, consequently it was not necessary to install main line switch and fuses again at the point of entrance. As a matter of fact, I did not suppose that it was going to improve the fire hazard particularly in having the rule strictly enforced at this point, but as I have the highest respect for the parties with whom the differences of opinion exists, I hoped to defend my position in stating that I was perfectly justified in standing firm on this requirement. In the first place the rule is a positive one, there being no "should" or "may" proviso to deal with, the rule stating postively that the switch must be placed on all service wires. Again, should we overlook or give way to a positive rule in a large installation which in turn has been carried out by a large contractor, the inspector would have to contend with objections from smaller contractors, who are only too ready to throw such a thing back at one when they are called upon to install service switches on their work, notwithstanding the fact that their proposition may be a totally different one to this. Again, I believe that it would be more convenient when necessary to replace main fuses, to be able to reach them conveniently from the inside of the building rather than be obliged to seek a ladder and climb up some twenty feet above ground on possibly a rainy or stormy night to handle heavy fuses. Just such points

as this often create a good deal of discussion, and the inspector is sometimes considered arbitrary, but I think when the matter is fairly discussed and looked at from all sides that there is nothing arbitrary about it. The contractor undertakes in his contract to do the work to the entire satisfaction of the Fire Underwriters. We therefore feel that there should not be any opening for debate on such a point as this. I, however, have submitted these points, together with other points already touched upon in this paper, and I shall be pleased to hear any discussion which may take place thereon.

At the conclusion of Mr. Strickland's paper, President Kelsch said: Mr. Strickland has remarked that the western interests did not see fit to take the time to go to the meetings held by the Underwriters in the east. As I said before, the meetings are held by the Underwriters joining with the representatives of electrical associations. It might be well to bring forth the fact that this Association has never sent a representative to those meetings to my knowledge. I think it would be advisable for this Association to have a representative attend those meetings.

Objections to Fireproof Case for Auto Starters.

Mr. Strickland touches on one point in his paper that I cannot let go by without saying a few words. He refers to the advisability of installing the controllers for induction motors in a metal case. Now, I hope Mr. Strickland is not serious on that point. In Montreal we have almost 2,000 induction motors on our system, aggregating 44,000 h.p.; 45 per cent. are under 5 h.p. and have no auto-starters; 55 per cent. of these motors have auto-starters. I made an effort to ascertain before leaving Montreal if we had ever had any trouble of any kind from an auto-starter, such as fire, or any damage of any kind due to the auto-starter being exposed and not enclosed in an iron case, and my information was that they have had no trouble of any kind such as would interest the Fire Underwriters. We have had bad contacts in auto-starters and we have had coils burn out, but we have never had anything happen to an auto starter that would have been protected or overcome if it had been put in an iron case.

Mr. W. L. Bird, manager and secretary of the Kaministiquia Power Company, Limited, writes to "The Canadian Electrical News" regarding Mr. Strickland's paper as follows: Referring to July number, page 18, of the 'News,'' Mr. Strickland brings out the point that all auto starters should be installed in a fireproof case. We presume this protection refers to fuses and switches only, as we have yet to hear of fires originating from this source, where auto starters were properly installed.

Though there may have been an isolated case, the contingency to provide against seems very remote, compared with the cost of proposed fireproof cases throughout. We trust that we have misunderstood Mr. Strickland's paper, or that the above is due to a typographical error, as we believe the question to be one of considerable importance to all operating companies.

Mr. H. U. Hart, chief engineer of the Canadian Westinghouse Company, also writes to "The Canadian Electrical News" regarding Mr. Strickland's paper. He says: I have read Mr. Strickland's letter published on page 18 of the July number of "The Canadian Electrical News," in which he states:

"The most satisfactory method of installing a starting and controlling apparatus in connection therewith (polyphase motors), is to install them entirely in a fireproof cabinet, that is to say, the auto starter, fuses and switch should be in a fireproof cabinet."

I believe it would be an undue hardship to users of polyphase motors for the Canadian Fire Underwriters to insist that auto starters be intsalled in an additional fireproof cabinet, as the standard makes of auto starters are now entirely enclosed in cast iron boxes. I have never seen or heard of any trouble which would increase the fire risk due to the operation of auto starters. If the coils should become short circuited or if there would be arcing at the switch due to poor contacts, the cast iron box which completely encloses the auto starter would prevent fire resulting. I agree with Mr. Strickland that the fuses and cutouts should be installed in a fireproof cabinet.

It is reported that the municipal power plant at Bonnington, nine miles west of Nelson, on the Kootenay river, of 1,500 horse power, which supplies the city with light and power for tram way and industries, has been taken over by the city of Nelson. The needs of the city are growing so fast that a second unit has become necessary, and a by law will be submitted this month for the purpose. The plant's capacity will be doubled by this time next year.

Trade Enquiries.

The Dominion Government Trade and Commerce reports contain the following trade enquiries. Readers of "The Canadian Electrical News" may obtain the names of enquirers by writing us. State number of enquiry.

1042. Agency.—A London firm manufacturing electric cables wishes to be placed in communication with parties in Canada who might be prepared to take up their agency.

754. Engineering Goods.—A firm of engineers' agents is desirous of receiving catalogues from Canadian firms making any engineering goods or appliances suitable for English use.

951. Lamps and Electric Fittings.—Inquiry has been received from the London office of a Birmingham manufacturer of lamps and electric fittings for the names of Canadian buyers of such goods.

1082. Electric, Steam and Hand Cranes.—Inquiry has been received from a Scottish manufacturer of electric, steam and hand cranes of every description for the names of likely buyers in Canada.

A Manchester firm manufacturing electrical assessories, switch gear and ironclad goods of every description desires correspondence with enterprising firms importing these materials. The specialties include a watertight ironclad plug and socket, suitable for mining, etc., and fuses for shiplighting. Persons interested should address "J. H." care Canadian Electrical News, Toronto.

Sparks.

The new branch telephone line from New Westminster to Burnaby lake has been compelted and will be put into commission at once.

Rapid progress is being made with the completion of the Eburne-New Westminster line and other extensions of the B. C. E. Railway.

A new building for the B. C. Telephone Company, which will house a larger switchboard, is now almost compelted and will be in use in a few months.

The Bell Telephone Company has refused an offer from the council of $25,000 for its equipment at Fort William. It is still considered as probable, however, that a bargain will be made.

The city clerk of Fort William has advised the council that E. S. Rutledge and W. J. Ross have been appointed members to act on the board which will operate and manage the electric street railway jointly with Port Arthur.

Improvements are about to be made in the Kamloops telephone service. Provision is to be made for an increase of 307 in the number of telephones, in addition to which preparations are being made to supply Fruitlands and Tranquille.

Mr. James Kent, manager of the C. P. R. Telegraph system in a recent interview said that the C. P. R. was testing the despatching of trains by telephone. In order to test the system fully, the line between Farnham and Montreal, a section over which many trains are operated daily, particularly in the early morning, was selected.

The town council of Smith's Falls has leased what is known as the Foster Grist mill and water power plant for ten years at $1,000 per annum, with the option of purchasing within two years for $16,000. The water commissions will use the power, in connection with the water pumps, and thus save considerable in the purchase of coal.

The Brantford City Council at a special meeting recently decided to expropriate the plant of the Western Counties Power Company, which is controlled by Cataract interests. The power company is said to want $37,000 for its equipment, but the matter will probably go before a board of arbitration. It is said also that the company will submit new figures for the street lighting contract. The present figure is $55 per arc light.

C. Rummel, general manager of the light department of the B. C. Electric, was in Chilliwack, B. C. recently completing arrangements for the lighting of the city. It is now definitely stated that the Chilliwack Manufacturing Company will furnish the power at their mill on the other side of Sardis. Even a better service will be given Chilliwack than at first anticipated, it being considered at first that light up to midnight would be sufficient, but now through an arrangement with Mr. Hall a continuous service will be given.

QUESTIONS AND ANSWERS

GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS:

1. All enquiries will be answered in the order received, unless special circumstances warrant other action.
2. Questions to be answered in any specified issue should be in our hands by the close of the month preceding publication.
3. Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment should be placed in the hands of a consulting engineer, caot be c onsidered in this department.
4. To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possible doubt as to the information required.
5. In all cases the names of our correspondents will be treated confidentially.

Question No. 1.—I am operating a small lighting plant, consisting of a 60 k.w., 2,300 volt, 125 cycle generator, and would like to ask you whether it is best to build up to full voltage first, or to throw in the switches before the machine is up to speed?

Answer.—About the very best way to start such a plant as you describe, or in fact any plant that does not operate a 24 hour service, is first to close all switches, both those controlling the fields as well as the main switch, set your rheostats at a point which will give you somewhat less than normal voltage, and then start your engine or waterwheel. This will result in the potential being applied to the system very gradually, which is not only a good thing as far as the insulation of the apparatus is concerned, particularly the transformers, but which also allows anybody who might be working on the primaries, or be accidentally or unknowingly in contact with them, a chance to escape, as the gradually rising pressure would make itself felt before it got to a dangerous value. Further, should there be a short circuit on either primary or secondary, it would at once be noticed, either from the ammeter or the behavior of the generator, and the equipment would thus be saved the heavy strains which always result from throwing a machine running at full potential onto a short circuit, to say nothing of the annoyance of blown fuses, etc.

Conversely, the best way of shutting down is to shut off the engine or wheel, and then, when everything is at rest, or nearly so, open your switches. This method obviates all sudden changes in either the electrical or the mechanical stresses, a feature much to be desired.

Question No. 2.—In wiring up compound wound direct current generators, does it make any difference whether the ammeter is in the positive or the negative lead, also is it better to use triple pole or single pole switches?

Answer.—The ammeters should all be connected into the negative leads, assuming that the series fields are on the positive side, because if you put your instruments into the positive leads they are then in parallel with the equalizers, and consequently may not exhibit the true load on the machine, as some of its current may be going out through the eqqualizer winding. Regarding switches, for all medium sized currents, we would suggest a double pole switch, for the equalizer and the positive, and a single pole for the negative. With this combination the closing of the double pole switch allows the series field of that particular machine to build up at the same time as the shunt winding, consequently when you throw the machine onto the line, by closing the single pole negative switch, you do not get any variation worth speaking of in the loads carried by the different machines. This ability to put a machine into parallel with others without any sudden alterations in their respective loads is a very desirable feature. The use of a three pole switch, especially with highly compounded machines, nearly always makes a generator take quite a heavy load the instant it is thrown into parallel with another, this being due to the sudden increase in its voltage from the current taken by the series fields.

In machines of heavy amperage, especially if the switchboard be any great distance from the generators, it is desirable to use single pole switches, one each for negative, positive and equalizer. The latter can then be placed on the machine itself, or on a pedestal near it, thus decreasing the wiring, as the equalizer need not then go to the switchboard at all. Besides this, due to the lesser drop of the shortened equalizer, the machines will compound more readily.

Question No. 3.—What is a reliable test for water in transformer oil, and if it is found, how can it be removed?

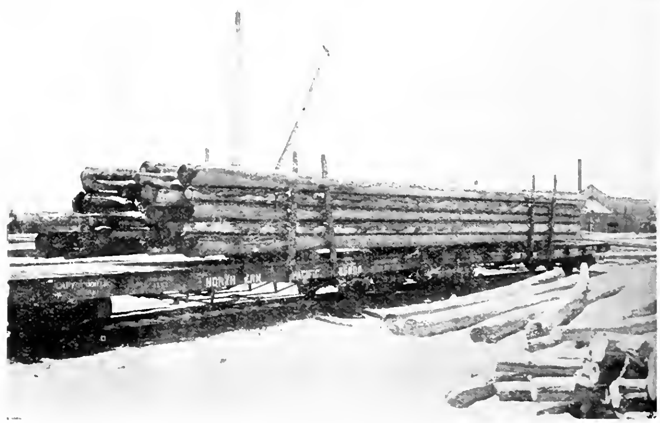
Answer.—As water is of higher specific gravity than oil, it will generally be found at the bottom of a transformer. This means that in taking out a sample for test you should be most careful to get some from the bottom of the transformer, or the oil barrel, though it is of course desirable to take some from other parts as well. A fairly simple way to test for water is to plunge a red hot iron rod into the sample, if water be present it will be turned into steam with a series of little explosions. Another way is to heat some copper sulphate crystals until they disintegrate into a white powder, and then pour the powder into the sample to be tested. If it turns blue again, or even shows a bluish tinge, you can be fairly sure that water is present. Of course the most reliable test of all is to make a high voltage reading on the oil and find what potential it will stand before breaking down. It is usual to place the electrodes, which are immersed in the sample under test, about 200 mills apart, under which conditions dry oil will not break down until a pressure of about 20,000 to 30,000 volts has been applied, the exact figures depending on the type of oil under test.

If water be found present the best way to remove it is to heat the oil and thus drive out the moisture in the shape of vapor. The process is much facilitated by passing air through the oil at the same time. This can be obtained from any source of air pressure that is handy, such as an air pump, or even a blacksmith's bellows. If you can make arrangements to pass the air over calcium chloride that will ensure that it itself is perfectly dry before it enters the transformer, heating it is also an advantage, especially in extra high voltage work. The oil can be heated by putting a resistance coil into the tank, and passing current through it, by a fire outside the tank, or by short circuiting one of the windings of the transformer, and applying a low alternating voltage to the other, just sufficient to make about full load current flow in the windings. This should be adjusted as may be necessary until the oil reaches a temperature of say 80 degrees to 100 degrees Centigrade.

Van Alstyne & Hills, Hamilton, Ont., dealers in gas and electrical supplies, are reported to have dissolved.

British Columbia's Cedar Makes Splendid Poles

British Columbia is known for its splendid forest trees, probably as much as for any of its natural products. The British Columbia cedar, from which splendid telephone poles are made, grows straight and round to a great height. The Lindsley Brothers Company, a registered Canadian corporation with head offices in Spokane, Wash., are now going into the market with a larger stock of telephone poles than they ever carried before, the total being nearly 150,000 poles. In Canada they direct their operations from Nakusp, B. C., where they have a large yard stocked with about 20,000 poles. At Summit Lake they have 15,000 poles and as many more are now arriving. The company claim to be the only pole "specialists" doing business in B. C. timber, and they name delivered prices to any point, making a specialty of seasoning their poles throughout before shipment. They keep in stock poles of all sizes from five-inch twenty-five feet to eighty feet. The company claim that the western pole is capable of being shipped into the eastern market in competition with eastern prices and that the buyers obtain a superior pole. They have been in operation now, for fifteen years, and with a manager in charge of every yard, inspecting the poles when they arrive and when they are shipped, they are able to produce splendid poles. They also are equipped to furnish cross arms from their factory in Portland, Oregon, the heart of the Douglas fir country. This factory is equipped entirely with modern machinery and manufactures only Douglas, red fir cross arms. Mr. G. L. Lindsley represents the company at Chicago, where their eastern sales office is located in the Monadnock Block.



A Load of 70 to 75 Foot Western Poles.

Idaho and British Columbia cedar, the company claim, are identically alike in quality and appearance. They state that it is a misnomer to refer to "western cedar" as "red cedar," because the timber is not red and the odor is radically different from the Tennessee red cedar. It is also darker in color than Michigan or Ontario cedar. Western, or British Columbia cedar is noted for its great height, straightness and roundness. In some cases although the butts do not equal in size, those of eastern cedar, the company state that they make up in strength what they lack in girth.

The Lindsley Company claim to be the originators of the term "Western Cedar," having adopted it in their advertisements eight years ago, and also to be the original shippers and introducers of western poles into the east, having been carrying on this class of business for nearly ten years. They state that the western pole has withstood the test of strength everywhere, and that it is being specified for its durability and strength in preference to other classes, particularly in the United States where Michigan white cedar and western cedar have been put to a comparative test, with the following results. Two samples of Michigan white cedar both cracked and broke at a pressure of 900 for the first sample and 800 for the second. Four samples of western cedar cracked and broke at the following pressures: No. 1, 1,600; No. 2, 1,100; No. 3, 1,400; No. 4, 1,100. The tests were made at the Pittsburg testing laboratory. Sections number one in both Michigan and western cedar were cut from the butts of the poles after being seasoned at the point, six feet from the butt, so as to get ground line resistance. The No. 2 samples were taken five feet from the top so as to get resistance at cross arms.

Shippers of "western cedar" have adopted the official specifications in use by the Idaho Cedarmen's Association. According to these specifications, for sizes from four-inch twenty-feet, and upwards, poles must be cut from live, growing cedar, peeled, knots trimmed close, butts and tops sawed square, tops to be sound and to measure as follows in circumference: 4-inch poles, 12 inches; 5-inch poles, 15 inches; 6-inch poles 18½ inches; 7-inch poles, 22 inches; 8-inch poles, 25 inches; 9-inch poles, 28 inches; 10-inch poles, 31 inches. No pole is to have more than one crook, which shall be one way only with a sweep not greater than 1 inch to every 6 feet in length. Butt rot in the centre, including small rig rot is not to exceed ten per cent. of the area of the butt. Butt rot which impairs the strength of the pole above ground is a defect. Large knots, if sound and trimmed smooth are not a defect.

The illustration accompanying this article shows a load of 70 to 75 foot western poles. The company claim that their yards in British Columbia are in a class by themselves, because they seldom see a pole with a rotten butt or top. Under the regulations outlined above, and with the benefit of the test results also explained, this company should confidently look forward to extending their Canadian business continually.

Personals.

Mr. Clyde K. Green, traction manager of the Dominion Power & Transmission Company, Hamilton, has been appointed master of construction. Mr. Fred B. Griffith had been temporarily appointed superintendent of traction, with Mr. John Gibson as assistant.

President R. B. Benjamin of the Benjamin Electric Manufacturing Company, Chicago, has gone to London, England, to establish a branch office and factory for manufacturing and handling their wireless clusters and lighting specialties abroad. He is accompanied by Mr. B. J. Grigsby of the Engineering Department, who will be left in charge upon Mr. Benjamin's return. A stay of from four to five weeks is contemplated.

Mr. Edward B. Merrill's many friends in Toronto will be glad that he has returned to the city and has opened an office. He occupied the position in Winnipeg of electrical and chief assistant engineer on the Winnipeg Hydro Electrical Development Company. Before going to Winnipeg he was in Toronto, and was connected with the Toronto Niagara Power Company during their construction period. He will take up consulting engineering and give attention to hydro-electric and other similar engineering undertakings. Mr. Merrill's experience in Europe and the United States, as well as in Canada, and his status as a graduate of Toronto University, both in arts and engineering, render him one of the best equipped Canadian engineers in the profession.

Mr. and Mrs. D. K. McLaren of Montreal celebrated the 53rd anniversary of their marriage on July 30th and both are enjoying the best of health. Mr. McLaren is president of D. K. McLaren, Limited, manufacturers of leather belting and mill supplies, and has been in the leather business for the past sixty years. He still takes an active part in the business. On account of the enormous expansion of his business, it was formed into a joint stock company in the early part of 1907. Mr. McLaren's sons, W. Fred McLaren and R. M. W. McLaren, who have been associated with him for the past twelve years, were appointed vice-president, and secretary and managing director of the company. "The Electrical News" joins Mr. and Mrs. McLaren's many friends in wishing them many more years of happy wedded life.

E. J. Haughton, formerly with the C. P. R. Telegraph Company for a number of years, and now in charge of the Dominion Government radio-telegraph station at Gonzales hill, has been appointed superintendent of the whole system on Vancouver Island. At present there are five stations, including the local one, the outside ones being at Point Grey, Cape Lazo, Estvan and Pachena. From all these stations Mr. Haughton will in future receive reports, the conduct of the system being placed in his hands.

Mr. Haughton's services, both to the government and the public, during the time he has been at the Gonzales hill station, have been generally appreciated, and the announcement of his promotion to the post of superintendent will be greeted with satisfaction in all quarters.

Trade Notes.

Electric Specialties, Limited, Toronto, have been awarded the contract for dry batteries, by the Government of Alberta, for "x cells." This is a gratifying illustration to the company, of the excellence of their goods in competition with others.

The Canadian Crocker-Wheeler Company, Limited, have sent us a useful library file for the preservation of their bulletins, together with a number of their recent bulletins. The gift is very welcome, as we were beginning to lose track of these useful publications which come in from time to time and had no alloted place. The file is substantially made and bears the company's well known trade mark on the cover.

Bulletin No. 103 of the John McDougall Caledonian Iron Works Company, Limited, tells about their Worthington single stage turbine pumps. The Worthington turbine built by this company is the result of a long series of experiments by their engineers. The single stage turbine pump by means of the conversion of the centrifugal motion of the water into potential energy by the diffusion vanes is able to operate against high heads. Bulletin No. 103 contains a number of other interesting details relating to the company's product.

J. F. B. Vandeleur, representing Connoly Brothers, Limited, Manchester, Eng. is placing on the Canadian market their special enamelled insulated wire.

This enamel insulation, the company claim is the result of a peculiar change or polymerization of Stearine pitch brought about as a result of a treatment in the process. This change is very analagous to that produced in the vulcanization of india rubber, but in this (enamelling) process no sulphur is used, and when the enamel is once fixed it is claimed that it becomes unalterable in its characteristic properties.

The Weston Electrical Instrument Company have recently entered the alternating current field with an initial line of switchboard and portable instruments. These instruments are similar in outward appearance to the well-known types of Weston instruments. A few of the features claimed for them are that there is no descernable inductance, chamber or working errors, that they are as dead beat as the well-known direct current Weston instruments and have a scale which surpasses all others in uniform spacing

At present the Weston Company supply voltmeters, ammeters and wattmeters, and intend within a few months to include polyphase wattmeters, power factor and frequency indicating instruments, thus making a complete system of A. C. instruments similar in quality with their D. C. apparatus. The Weston Company have placed the Canadian trade in the hands of the Engineering Equipment & Supply Company of Montreal; and Messrs. Joyner-Greene of Toronto, who are respectively their eastern and western agents.

In consequence of the rapid growth of the city of Calgary it has been found necessary to triple the capacity of the municipal lighting plant. The present equipment, including a 260 k.w. engine type alternating current generator, exciter generator, switchboard, transformers, lamps, pole, line, etc., was furnished only two years ago by the Allis-Chalmers Bullock, Limited, of Montreal. To the same firm a contract has now been given for a 750 k.w. engine type alternator, 30 k.w. exciter generator, switchboard, and other auxiliary apparatus.

Canadian Products in France.

A shipment of more than usual interest to Canadians in general and telephone men especially was made recently by the Canadian Independent Telephone Company, Limited, of Toronto, to Lyons, France. The shipment was one of automatic telephone equipment for installation in the city of Lyons. It was manufactured at the factory of the Canadian Machine Telephone Company, Duncan street. The installation at Lyons will be a commercial exchange of the Lorimer automatic telephone system, and will be complete in every particular, including the toll board for connecting outside lines with the automatic telephone plant in the city. The automatic switchboards are the most up-to-date that this company has turned out, being similar to the plant which this company has installed at Peterboro, but furnishing special automatic service for private branch exchanges, a time limit service for subscribers and a complete supervisory and alarm system. The Canadian Independent Telephone Company has the contract for the complete plant and everything is being shipped from Toronto, with the exception of the storage batteries.

The order was placed here by the Societe Internationale de l'Autocommutateur Lorimer of Paris, France and Mr. Israel, a representative of this company, has been in the city for several weeks past watching the completion of the plant. He left recently to return to the French capital, and was extremely well satisfied with the equipment that was going forward and the manner in which it had been handled. It is understood that this installation at Lyons will have an immediate bearing on the French Government's future telephone systems throughout that country.

The Canadian Independent Telephone Company made a shipment early in June to Rome, Italy, where an exchange of the Lorimer system is also being installed. These orders were placed here after the representatives and engineers of the European company and the French Government had carefully examined this telephone equipment and investigated the various other systems.

An Opening in Peru.

A letter was received in the offices of the Canadian Manufacturers' Association, Toronto, recently, in which a former Torontonian, Mr. E. C. Austen, states that the present horse car system in use in the town of Arequipa, has become inadequate, and suggests that through the Canadian Manufacturers' Association something might be done to electrify the town's tramway system. Several prominent men in Arequipa are endeavoring to interest capital in the scheme, including the British Consul, Mr. George Stafford, and Senor E. C. Ureta, the president of the Credito Urbano de Arequipa. These men have engaged engineers to estimate the cost, and it is understood that £50,000 would cover everything, including an estimate of £8,000 for eleven passenger cars and ten freight cars.

The writer points out that Arequipa is a city of between forty and fifty thousand inhabitants, situated 100 miles from the coast, at an altitude of 7,600 feet. The city is second in size to Lima, the capital of the republic. The key to Arequipa's importance is the fact that it is the door through which almost all traffic in and out of the interior of Peru and Bolivia must pass. There are two large suburbs near this city, which are not as yet served by the horse car system. A summer resort three miles away, known as Trigo, is already connected.

The writer says that the financial situation of Peru is very good, gold being the standard of exchange. Engineers from Peru, brought in at the instance of Senor Ureta, managing director of the present horse car system, estimate that the traffic would be at least 3,000,000 people per year, with a freight tonnage besides this of frome 3,000 to 4,000 tons.

In an article from its Montreal correspondent, "Canada" says: "Interviews with the representatives and agents of several British manufacturers of machinery who have been devoting more attention to the Canadian market justify the statement that there is an increasing disposition to place in the United Kingdom orders which have hitherto gone to the United States. During the last couple of years there have been greater opportunities for British agents in Canada to show prospective purchasers engines and machines actually at work, to prove them to have splendidly stood the test of time, and to show their efficiency in workmanship, endurance, and output. In short, British products are advertising themselves and inviting comparisons on the spot, a state of things impossible when the imported article was almost invariably American. Other factors in the improving situation are the greater interest which leading British firms are taking in studying the special requirements of the Canadian user, and the presence of representatives who have practical knowledge of the details of construction and erection, and keep themselves well in touch with what their foreign competitor is doing.."

Electrolysis in Winnipeg.

The damage being done to Winnipeg city water mains by electric currents escaping from street railway rails came to the front again recently in connection with a break in a water main at Princess and Market. The main was found to be in a badly damaged condition and there was a positive current flowing from the pipe to a cable in the Manitoba Government telephone conduit. It is also stated that the city has had trouble with a water main at the corner of Broadway and Main street.

There have been seven telephone cables put out of commission in one week and officials are investigating to find out whether electrolysis was the cause of the trouble. The Winnipeg city electrician states that under peculiar circumstances telephone cables as well as water mains might be damaged by escaping currents. It is being pointed out as significant that both the telephone officials and the city officials have had trouble with telephone cables and water mains respectively at Broadway and Main and at Princess and Market.

There were 250 telephones out of order as a result of the trouble at Princess and Market. The cables have also given trouble on River avenue as well as at Market and Princess and at Broadway and Main. Four hundred telephones were out of commission in Fort Rouge.

The electrolysis question is not a new one as far as Winnipeg is concerned, but this is the first time that it has been mentioned in connection with the telephone system. No account was taken of any possible damaged condition of the telephone cable through electrolysis when the Bell Company sold the system to the Manitoba Government.

Rope Driving for Generators.

An article on rope driving for generators is published by "Power and Transmission." Steadiness, elasticity, noiselessness and practically non-slipping operation, are the principal claims made in favor of rope driving, as compared with belt and pulley driving. On small units the initial cost of belting and pulleys will be less than for a rope drive outfit. But as the size of the unit increases, it is claimed that the cost of belting rises so rapidly — especially for the long centre to centre distances advisable in generator driving—that the lower cost of rope soon establishes a relation of equality between the two methods, so far as initial cost is concerned. On the larger units the balance is said to be greatly in favor of the rope drive.

After dealing with the question of moderate sized installations, the article has the following to say about rope driving for mining machinery: "No other field of power usage imposes upon an electric generator the severity of conditions which are found in mining service, where the generator may be called upon to make an instant jump from light load to very heavy load, or even overload, as when an electric locomotive hauling cars in the mine is started with a heavy train. These sudden and violent fluctuations in load may occure repeatedly, at frequent intervals through the entire working day.

"Under these conditions, as is well known, a belt-driven generator does not and cannot operate quietly and steadily, nor can the direct connected unit assume its burdens of sudden overloads without evident difficulty. An elastic connection between the engine and such a generator is highly desirable. This the direct connected unit does not provide. The belted unit, while providing the desired elasticity, cannot operate quietly and steadily in difficult situations. The rope drive does combine with the desired elasticity, the ability to take care of an extremely varying load without noise, slippage or other sign of distress. The absence of slippage enables the rope drive to transmit instantly to the engine the retarding effect of an increase of load, enabling the governor to respond quickly and provide the power necessary to maintain full speed with the greater load.

Montreal's Interest in Ottawa Canal.

Senator Casgrain, speaking of the advantages that would be obtained from the contsruction of the Georgian Bay Canal, recently made especial reference to the effect of the canal upon Montreal. "The route by the Riviere des Prairies," he said, " or what we call the Back River, which is a branch of the Ottawa, would, in my opinion, be the preferable route. It is proposed to bring it to the level of the Lake of Two Mountains, and maintain that level to a point about one thousand yards east of where St. Denis street strikes the shore of the Back River. There then would be a fall of thirty-five feet, creating an effective water power of 60,000 horse-power at that point. It was also proposed to have another lock at Bout de l'Ille, which would be at the end of this Ottawa watercourse and where there would be a lift of 24 feet, giving also a water power of some 40,000 horse-power.

'This would mean 100,000 horse-power available within almost a mile of the city of Montreal. This 100,000 horse-power could be farmed out, and people would gladly pay $10 a year, for horse-power running for 24 hours a day, which would make no less a revenue than $1,000,000 yearly from the power generated at these two dams. From Shawinigan Falls 16,000 horse-power is brought to Montreal, a distance of eighty miles, and the price paid by the Montreal Light, Heat and Power Company is $15 per horse-power, or $240,000 a year to that one company. I may say that the Shawinigan Power Company also sell power to such an extent that their annual statement of revenue last year was very nearly $650,000, and for the current year it will be over $700,000.

"The Ottawa and Georgian Bay Canal construction would develop 100,000 horse-power within one mile of the present limits of the city of Montreal, and even if the Georgian Bay Canal were never built, I would strongly advocate the development of these powers. It would be a revelation to people living all their lives in Montreal to see that a dam across the Back River would develop at that point 60,000 horse-power. That is about one-fourth, or 25 per cent. of the horse-power required for all the lightning, heating and street car traction power in the metropolis of Canada.

"Even if no canal is built, it would be a great advantage to have those two magnificent sheets of water. The water back of the Island of Montreal would be dammed at Bout de l'Ille, and there would be a lift of twenty-four feet there. I may say that the intention is to make it 30 feet on the mitre sill of the entrance of that lock, in order that ocean vessels might come up to the second dam, and for all that distance of twelve miles in length you would have a depth of 30 feet. Therefore not only would Montreal have its present harbor, but you would have at the back of the city of Montreal an immense dockage space, which would give splendid shipping facilities.

"The working classes could leave Montreal and in twenty or twenty-five minutes be on the shores of

magnificent sheets of water for a five-cent fare. Think of the magnificent park that would be erected where people could go to breathe the fresh air. Think of the countless yachts, boats and skiffs that would ply on the lakes; and what an ideal residential city it would make of Montreal. Even if the Georgian Bay Canal project should be abandoned, if it were possible to build this dam it would be a great boon to the Island of Montreal generally and particularly to the working classes of that city. Why, Montreal would have a million population in a short time."

English Machinery Stands Endurance Tests Well.

Referring to endurance tests "Canada" says: "In this connection we may quote the opinion expressed by Dr. A. Shadwell in his special article on 'Machine Tools' in the Times, in which he says: 'A point in favor of the British manufacturer has been curiously brought out by the application of high speed steel. The increased pace puts a corresponding strain on the machine, and the effect has been to emphasize the characteristic defect of American machinery, in which strength is sacrificed to lightness. It is not so apparent in working the softer qualities of metal commonly used in the United States, but when hard steel is dealt with the stronger built British machines have a marked advantage; so that an 8 inch British lathe, for instance, will do the work of a 10 inch American one. In short, the old merit of thoroughness has once more vindicated itself through the development of this great novelty, and has enabled British makers to turn the tables on their rivals to whom they owe the innovation. It cannot be denied that in general they turn out better stuff, and it may be maintained, with considerable confidence, that at the present time their machine tools are more practical and efficient and in many cases more modern, as well as cheaper, than the American ones.'

"In the matter of deliveries, there is not now much to choose between the British and United States importers for large machinery. It is becoming of increasing importance for the English firm to keep certain machinery parts in stock at depots in such important centres as Montreal, Toronto, Winnipeg, and Vancouver. His United States competitor usually still enjoys the advantage of being more readily accessible in cases of emergency."

Manitoba's Telephone Plans.

The Manitoba Government has decided on a number of telephone extensions for the forthcoming season. They consist of new long distance lines, additional circuits on existing long distance ilnes, the connection of rural subscribers to existing farm lines, the completion of the Fort Rouge exchange and subways throughout the city, and the building of rural exchanges, in all costing over $500,000. The following long distance lines will be built, it is hoped, during the year: Selkirk to Gimli, connected with Clandeboye, Whytewold and Winnipeg Beach, 42 miles; Minnedosa to Binsearth, via Basswood, Strathclair, Shoal Lake, Kellog, Birtle and Foxwarran, 90 miles; Hamiota to Crandell, 11 miles; Virden to Pipestone, 21 miles; Minto to Belmont, 27 miles; Baldur to Somerset, 32 miles; Somerset to Miami, 22 miles; Snowflake to the boundary line, North Dakota, 1 mile; Brandon to Rounthwait, 20 miles; Pilot Mound to Baldur—Somerset line—7 miles; Ste. Rose du Lac, Makinak and Laurier to Dauphin, Neepawa line, 5 miles; Winnipeg, through Springfield to Lorette and Ste. Annes, 25 miles. Copper circuits will be added to existing pole lines from: Winnipeg to Selkirk, 23 miles; Souris to Hartney, 32 miles; Brandon to Portage la Prairie, 80 miles; Brandon to Pilot Mound, 95 miles; Dakota Siding to Miami, 63 miles; Elm Creek to Trehern, 37 miles; Miami to Morden, 19 miles; Morris to Myrtle, 21 miles; Morden to Darlingford, 13 miles; Pilot Mound to Lariviere, 12 miles; Crystal City to Holmfield, 31 miles; Killarney to Ninga, 16 miles; Dauphin to Kelwood, 66 miles; Morris to Morden, 41 miles; Portage la Prairie to Gladstone, 35 miles. The cost of materials necessary to build a mile of single circuit, bracket pole line, including a telephone, is estimated at $75. It is estimated that at least 3,000 rural subscribers will be provided with telephone service this year.

Canadian Power Company Flourishing in Brazil.

The report presented at the annual meeting of shareholders of the Sao Paulo Tramway, Light and Power Company showed that the gross earnings for the year were $2,111,533.14, an increase of $92,819.22 over 1906, and net earnings were $1,395,873.50, compared with $1,368,162.77 in 1906. Out of gross earnings operating and maintenance charges took $715,649.64, bond interest, taxes, etc., $359,422.87, and dividends $691,476.11, a total of $1,766,548.62, leaving a surplus of $344,974.52. Of this, $100,000 was transferred to contingent account, and $244,974.52 carried forward to credit of profit and loss. During the year $131,074 has been expended upon renewals, etc. The company reports a steady growth in its business. There are now in use 45,570 arc and incandescent lamps, compared with 38,119 in 1906, an increase of 19.5 per cent., and there are now 310 power customers, as against 245 at end of 1906. The horsepower contracted for shows an increase of 1,102½ h.p. In the way of capital expenditure, $743,871.88 has been expended, and the new Santo Amaro reservoir will be ready for storage of water by June 1. A contract has been placed for the seventh unit, which is expected to be ready before December, 1908. Twelve cars have been added to the company's rolling stock during the year, and 25 more are ordered. The company has secured an exclusive 30-year concession for light and power in Sao Paulo, distant ten miles from Sao Paulo.

The net income per cent. of capital stock is 12.4 per cent., as against 13.4 per cent. in 1906. The following directors were re-elected for the ensuing year: William Mackenzie, Frederic Nicholls, Alexander Mackenzie, Hon. Geo. A. Cox, Sir H. M. Pellatt, Z. A. Lash, E. R. Wood, Dr. F. S. Pearson, R. M. Horne-Payne, J. H. Plummer.

The Pitner Lighting Company, incorporated under the laws of the Province of Manitoba, have been licensed to carry on business in Ontario on a share capital not to exceed $40,000.

Sparks.

The Milestone & Southwestern Telephone Company, Milestone, Sask., have completed about 27 miles of their system. About 47 subscribers have been secured.

The Strathcona City Council have decided to sell their telephone plant across the river in Strathcona to the provincial government, the consideration being $1,000.

The Montreal City Council have passed the ordinance granting a franchise to the Canadian Light & Power Company. The by-law requires the company to supply 5,000 h.p. by 1910 and 20,000 h.p. by 1915.

The Manitoba Telephone Commission at Winnipeg have received applications from some 1,350 farmers in the province who want rural telephones, and arrangements are now being made to accommodate them.

The Westmoreland Power Company have applied to the legislature for a charter. Among the privileges asked for is the right to construct and operate electric railways in the city of Moncton, N. B., and through the counties of Westmoreland, Kent and Albert.

The Government telephone line connecting Carlyle, Sask., and Alameda, Sask., will be built this summer and extended from Carlyle north to Wapella, Saltcoats and Yorkton. It is expected that a local system will be put in to connect with the Government line. F. J. Stent is town clerk.

The Northern Electric Manufacturing Company, Limited, of Montreal has obtained an extra provincial license to carry on business under the laws of British Columbia. Mr. H. W. Kent, late superintendent of the B. C. Telephone Company, being their manager for the province, with offices at 427 Seymour street, Vancouver. This company is also Canadian representative of the Western Electric Company.

The following municipalities in Manitoba are constructing their own rural telephone systems: Brenda, Morton, Argyle, Woodworth and Wallace. Several others are to be added to the list in the immediate future. These systems are to be connected up by the Government long distance lines. In the municipality of Macdonald the farmers are constructing their own lines, and these will be connected with the Government trunk lines.

MOONLIGHT SCHEDULE, FOR SEPTEMBER.

(Curtesy of the National Carbon Company, Cleveland, Ohio.)

Date.	Light.	Date.	Extinguish.	No. of Hours
Sept. 1	7 00	Sept. 2	4 40	9 40
2	7 00	3	4 40	9 40
3	7 00	4	4 40	9 40
4	10 00	5	4 40	6 40
5	11 00	6	4 40	5 40
7	0 10	7	4 50	4 40
8	1 20	8	4 50	3 30
9	2 30	9	4 50	2 20
10	No Light	10	No Light	
11	6 50	11	9 00	2 10
12	6 50	12	9 30	2 40
13	6 40	13	10 00	3 20
14	6 40	14	10 30	3 50
15	6 40	15	11 00	4 20
16	6 40	16	11 40	5 00
17	6 40	18	0 30	5 50
18	6 30	19	1 20	6 50
19	6 30	20	2 10	7 40
20	6 30	21	3 10	8 40
21	6 30	22	4 10	9 40
22	6 30	23	5 00	10 30
23	6 30	24	5 00	10 30
24	6 20	25	5 00	10 40
25	6 20	26	5 00	10 40
26	6 20	27	5 00	10 40
27	6 20	28	5 10	10 50
28	6 20	29	5 10	10 50
29	6 20	30	5 10	10 50
30	6 10	Oct. 1	5 10	11 00
		Total	....	208 20

Sparks.

At Sydney, N. S., a special committee has been appointed to consider the proposition to erect an electric light station.

The Western Saskatchewan Telephone Company are making arrangements to build a line between Drinkwater, Sask., and Belle Plain.

The contract for the Goderich section of the Ontario West Shore Electric Railway has been awarded to the Huron Construction Company.

The North West Electric Company successfully tendered for the electric wiring of the new hospital to be erected at Calgary, their figure being $5,500.

The Alberta Public Works Department has purchased property at Strathcona, Alta., for the erection of a local telephone exchange building at a cost of $10,000.

William Howard, Secretary-Treasurer, Miniota, Man., took tenders up to July 30 for the construction and installation of telephones required in the proposed rural telephone system.

Tenders have just been received by W. W. Northcott, purchasing agent, Victoria, B.C., for 40,000 7-16 inch x 12 inch copper coated carbons and 10,000 7-16 inch x 8 inch copper coated carbons.

Rufus Marr, Secretary-Treasurer, Municipality of Bredna, Waskada, Man., has just taken tenders for $40,000 four per cent. 20-year debentures, issued for the construction of a telephone system.

Tenders have just been taken for clearing and grading the second section, Cloverdale to Abbottsford, 26 miles of the Westminster-Chilliwack Railway. Charles Garden, Vancouver, B. C., is engineer, B. C. Electric Railway.

It is now definitely stated that the Bell Telephone Company will erect a new five-storey exchange on the Carrol property at Bay and Adelaide streets, Toronto. The estimated cost of the proposed building is $250,000.

Tenders were received by S. P. Porter, Deputy Commissioner, Department of Railways and Telephones, Regina, until July 30 for telephone supplies, including insulators, top pieces, cross arms, guy wire and pole line hardware.

The city of Saskatoon, Sask., has disposed of bonds amounting to $400,000, issued for the installation of new waterworks, electric lighting and sewerage systems. Willis Chipman, 103 Bay street, Toronto, is consulting engineer.

Allis-Chalmers-Bullock, Limited, Montreal, Que., have obtained the following contract in connection with the extension of the Calgary, Alta., lighting plant: 750 k.w. engine type alternator, 30 k.w. exciter generator, switchboard and auxiliary apparatus.

The British Insulated & Helsby Cables Limited, Montreal, have just closed a contract with the Montreal Light, Heat & Power Company to supply and instal about $50,000 worth of extra high tension three-core cable, the work to be completed so as to enable the mains to be used this fall.

James W. Campbell, of Toronto, general manager of the Buffalo, Lockport & Rochester trolley line, has succeeded Chas. B. Hill, of Buffalo, N. Y., as president of the road. Mr. Campbell will establish his headquarters at Rochester, N. Y. Albert Oakley, of Toronto, remains vice-president, secretary and treasurer.

From Sherbrooke, Que., comes a report that Burroughs Falls has been sold to a syndicate who will build a factory for manufacturing carbide. It is further stated that they are also negotiating with parties at Boynton for the purchase of the water power in that place, with a view to establishing an electric light plant.

Supplementary letters patent have been issued increasing the capital stock of the Toronto Power Company from $100,000 to $1,000,000. The company is one of the Mackenzie and Mann corporations, and will control the Electrical Development Company, acquired during the winter. The increase of capital is asked in connection with the financing of the power plant.

Cedar Poles

from

"British Columbia"

The strongest, straightest and soundest pole that grows in the "WORLD."

We can ship them East as far as Quebec and compete with Eastern poles—40 ft. and longer.

In Ontario we can compete only on 35 ft. poles and longer.

In Manitoba—30 ft. and longer.

In Alberta and Saskatchewan we are "IT" on all lengths.

Don't be afraid of them. They are the leading pole for City and Power line construction.

Yards on C. P. Railroad in British Columbia, Kootenay District.

We name delivered prices **always** and guarantee immediate shipment.

Write for car load prices on our **Oregan Fir Cross-Arms.**

The

Lindsley Brothers Company

Spokane, Washington

Jobbers and Dealers are Rejoicing

For having found a new line which pays them to handle. They are getting REPEAT ORDERS on every barrel of our batteries they sell. AND WE PROTECT THEM.

Our X Cells are Guaranteed

They Certainly Have Nine Lives.

They Excell All Others.

Selling Prices

	cents
No. 6 X Cells in Barrel lots	19
No. 6 White Kitten "	16
No. 7 X Cells "	38

We ship FRESH GOODS on date the order is received. If in Toronto, inspect our up-to-date plant.

Electrical Specialties, Limited

12-14-16 Shuter Street - - Toronto

CANADIAN INVENTION
CANADIAN ENTERPRISE
CANADIAN CAPITAL

CANADIAN
INDEPENDENT
TELEPHONES

Canada invented the Telephone.

Canadians invented

CENTRAL ENERGY AUTOMATIC TELEPHONY

We are building up a new Canadian industry, manufacturing and operating Telephones and Telephone Supplies in Canada in opposition to the Telephone Trust.

We have a FULL LINE

Magneto-Central Energy Manuel-Lorimer Automatic

We are prepared to engineer, equip and instal complete telephone systems.

WRITE FOR PARTICULARS

Canadian Independent Telephone Company, Limited

26 Duncan Street, TORONTO, Ont.

Sparks.

An additional car barn will be built by the Ottawa Electric Railway.

The Stratford City Council has decided to submit by-laws to authorize the signing of the contract with the Hydro-Electric Commission.

The electric light plant at Merritton, Ont., is to be reconstructed and K. L. Aitken, E. E., Toronto, has been appointed consulting engineer.

In a recent conflagration at Fort William, Ont., the Bell Telephone plant was entirely destroyed at a loss of $2,000. The total losses occasioned by the fire amounted to $161,000.

The Montreal & Southern Counties Electric Railway Company have opened offices at 606 Canadian Express Building, McGill street, Montreal. W. B. Powell, manager; J. A. Burnett, superintendent and electrical engineer. Work is now proceeding on the Montreal-St. Lambert section of this road, and entry into the city of Montreal has been arranged for.

At a recent meeting of the City Council of West Toronto the question of entering into agreement with the Toronto & Niagara Power Company was discussed at length with Mr. C. A. Martin, solicitor for the company, and the Council finally concluded to enter into no agreement with the company. The company claim that they have under their charter the right to construct power lines through the city, and Mr. Martin again explained to the Council that the company's only object in seeking an agreement is that matters of detail as to construction work may be all decided.

The prospectus of the West Kootenay Power & Light Company sets forth fully the advantages the company anticipate reaping, one of the factors being the interest which the Canadian Pacific Railway Company is taking in the company. The development of power is an important factor in the progress of the west, and as the company's plant is at Bonnington, only thirty-five miles from Rossland, it will be obvious that there is a demand for power in that district. The stock offered amounts to £240,000 in 6 per cent. bonds of £100 each, redeemable in September, 1940, with semi-annual interest.

Among recent concerns to obtain charters are: The Seymour Power & Electric Company, Limited, Campbellford, Ont., incorporated, capital, $1,000,000; incorporators, A. G. Ross, M. L. Gordon, J. F. McCarthy, W. S. Edwards and G. C. Loveys, all of Toronto. Minto Rural Telephone Company, Limited, Harrison, Ont., incorporated, capital, $10,000; incorporators, George Gray, E. W. Lambert, J. J. Prichard and A. Spotton, all of Harriston. Wheatley Telephone Company, Limited, Wheatley, Ont., incorporated, capital $20,000; incorporators, F. J. Fox, N. Coles, O. Lounsbury, J. M. Campbell, A. M. Wilson and J. H. Allan, all of Wheatley. Midland Electric Company, Limited, Montreal Que., incorporated, capital $49,000; incorporators, J. A. Jacobs, F. Goodwyn, A. L. Woolf, J. O. Oglivy and J. F. Miller, all of Montreal. Berna Commercial Motors, Limited, Toronto, Ont., incorporated, capital $250,000; incorporators, W. R. Barker, J. A. McEvoy, Gordon Russell and others, all of Toronto. Ontario Railway Signal Company, Limited, Toronto, Ont., incorporated, capital $40,000; incorporators, W. R. Parker, J. A. McEvoy, Gordon Russell and others, all of Toronto.

Position Wanted

Young Engineer with Mechanical and Electrical technical training at an English University, 4 years as assistant in Corporation Electricity Works, 7 years Mechanical and Electrical shop experience (English and Canadian) Highest references. What offers?
J W SMITH, 31-15th Avenue, Lachine, P. Q. Canada.

For Sale

Electric Lighting Plant and Carbons

The City of Winnipeg offers for sale the following apparatus and material:

Engine and Generator

One 100 h.p. Leonard-Ball High Speed Compound Condensing Engine. Cylinders 10"x16"x12"—practically new.

One S.K.C. 2,400 volt Two Phase Alternator with marble Switchboard.

Rheostats and Exciter.

Open Arc Carbons

40,000 5/8 x 14 National C.C. Carbons.
40,000 5/8 x 8 " " "

Any further information may be obtained from F. A. Cambridge, City Electrician, Winnipeg.

Bids for any or all of the above, addressed to the Chairman of the Board of Control, will be received up to TUESDAY, 15TH SEPTEMBER, 1908. Terms cash.

M. PETERSON,
Secretary Board of Control.

Winnipeg, July 15th, 1908. 9

Sparks.

The rural municipality of Woodworth, Man., have sold to Amelius Jarvis & Company, Toronto, $40,000 four per cent. twenty-year debentures, issued for the installation of a municipal telephone service.

W. H. Evanson, City Controller, Winnipeg, Man., invites tenders until August 14th for the purchase of $600,000, four per cent. power debentures of the city of Winnipeg. Further particulars may be obtained on application.

The long distance lines to be constructed by the Saskatchewan Government include the following: Lumsden to Prince Albert, connecting with the towns along the Canadian Northern Railway; a line to serve the towns and villages along the Arcola and Estevan branches of the Canadian Pacific Railway; branch lines east and west from Warman to the boundaries of the province and following the C. N. R.; branch lines paralleling the Wolseley, Reston, Pheasant Hills, Weyburn and Stoughton Railways; a line eastward from Prince Albert connecting Kinistino, Melfort, Star City, Tisdale and other towns and villages; a line crossing the province from north to south and connecting Alameda, Carlyle, Wapella, Yorkton and Saltcoats. Branch lines will also be laid out to follow the railway branches into the Goose Lake, Shellbrooke and other territory, including lines west from Moose Jaw. S. P. Porter is Deputy Commissioner, Department of Railways and Telephones, Regina.

Sparks.

The Toronto Power Company have been granted permission to increase their capital stock from $100,000 to $1,000,000.

The American Street and Interurban Railway Association will hold its annual convention at Atlantic City, N.J., from Oct. 12-16.

The Blindman River Electric Power Company, Lacombe, Alta., contemplate installing an auxiliary steam plant. E. J. Tett is manager.

The Wellesley & Mornington Telephone Association contemplate considerable additional construction work in the district of Crosshill, Ont.

The Trenton, Ont., Electric & Water Company are planning a large water power development. J. J. Wright, of Toronto, is manager.

John Harrower, Secretary-Treasurer, rural municipality of Argyle, Baldur, Man., recently took tenders for the construction of a telephone system.

Tenders were received by A. P. Power, secretary-treasurer, until August 31st for the construction of a telephone system for the rural municipality of Pipestone, Virden, Man.

The Blenheim and South Harwich Telephone Company will seek an entrance to Chatham, Ont., the Bell Company's franchise expiring this year. The new company would place their wires underground.

A public meeting was held at Drayton, Ont., a short time ago to consider the question of installing rural telephones and an organization was formed which included O. B. Henry, president, and John Lunz, secretary.

The Montreal Light, Heat & Power Company have placed an order with British Insulated and Helsby Cables, Limited, Montreal, for four miles of three core extra high tension cable to be installed before the fall. This makes a total of over ten miles of extra high tension cable ordered by the Montreal Light, Heat & Power Company from British Insulated & Helsby Cables, Limited, during the last three months.

Judge Ray, of the United States Circuit Court for the Northern District of New York, has granted a preliminary injunction against the Middleburg & Schoharie Light, Heat & Power Co. in the suit of the Westinghouse Electric & Manufacturing Co. against the Middleburg Company for infringement of the well-known Stanley patent No. 469,809. The Middleburg Company is a user of transformers manufactured by the Pittsburg Transformer Co. and it is the use of these transformers that constitutes the alleged infringement. The operation of the injunction is suspended until November 15th to permit the Middleburg Company to either remove the transformers or to appeal. z

Supt. Cambridge, of the Winnipeg Electric Light and Fire Alarm Service, was recently in Toronto investigating the latest methods of welding street railway rails, a subject of great interest to Winnipeg, where electrolysis evils are feared. Mr. Boyd of the Toronto Railway had the local apparatus at work for him, and welded two rails and cut off the piece to be taken to Winnipeg. Supt. Cambridge also visited fire headquarters yesterday to look into the alarm system, and he inquired into the new police signal system. Mr. Cambridge left for Chicago to investigate the electric lighting system there.

CANADIAN
ELECTRICAL NEWS
& ENGINEERING JOURNAL

PUBLISHED ON THE FIFTH OF EVERY MONTH BY
HUGH C. MACLEAN, LIMITED,

HUGH C. MacLEAN, Winnipeg, President.
THOS. S. YOUNG, Toronto, Business Manager.
JAMES FISHER, Toronto, Advertising Manager.

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362
F. W. SCHERBARTH, Representative.
MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative
WINNIPEG - - - - Telephone 224. 404 Travellers Bldg
ROLAND F. HILL, J. R. HOOPER, Representatives.
VANCOUVER - Telephone 2248. Molsons Bank Chambers
GEO. A. GALL, Representative

ADVERTISEMENTS.
Advertising rates sent promptly on application Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.
The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.
Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.
Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

The Hydro-Electric Campaign

For some little time past there has been more or less of a lull in the Hydro-Electric proposition, though latterly matters have assumed much more definite shape, the Commisison having awarded a contract for the construction of the transmission line, and this contract having been approved by the Cabinet, the head of the company which is to do the work being Mr. F. H. McGuigan, late of the Grand Trunk. Shortly after the announcement was made various statements appeared regarding alleged attempts to influence farmers against granting leases for tower sites, followed immediately by disclaimers from the present power companies. It is also said that anonymous communications are appearing in some of the English journals reflecting very strongly on the whole scheme, and the Ontario Government for fostering it. It is further stated that the present line to Toronto is to be extended east to Whitby and the neighboring towns, this being followed almost immediately by a denial from the company, and then by the announcement that steps are to be taken to provide for the Governmental line going down there. When you add to this the fact that Hamilton has signed a contract with the Cataract Company, that the mayors of several other towns have refused to sign the power by-laws unless compelled to do so by the courts, and that two suits have been launched against the Toronto by-law, it will easily be seen that the Government proposition has not yet come to plain sailing.

In the meantime the City of Toronto is to be congratulated upon having appointed a Canadian engineer in the person of Mr. K. L. Aitken to the very responsible position of Electrical Engineer in charge of the construction of the city plant. It is to be hoped that the various other bodies, both municipal and private, who may have need of technical assistance in connection with similar matters, will follow in Toronto's steps and appoint none but Canadians to their various staffs. For many years past our appointments have in a great many cases gone outside our own borders, notwithstanding that many capable men were to be had right at home. This point was recently taken up by the Engineers' Club of Toronto, representations being made by it to both Hamilton and Toronto, both of whom have been flagrant offenders. Mr. Aitkens' appointment is evidence that the effort was not by any means in vain, and as such is a subject of congratulation for all concerned. As a matter of fact, the question should be carried still further, and arrangements made that none but Canadian engineers should be employed on such a distinctly Canadian enterprise as the Hydro-Electric transmission line and its various accessories. We commend the point to the most earnest attention of the Commission, who will without doubt take a very right and proper step if they insert some such provision in their contracts.

The Oscillograph

Practically everyone has heard and read of the oscillograph, yet it is doubtful if all the descriptions ever written could equal the exceedingly well organized and most interesting demonstration of this instrument given by Mr. Price at the June Convention of the C. E. A. One reads about low power factor, and wave distortion, and leading currents, etc., and perhaps appreciates a little of their different effects if one is daily trying to overcome their baneful influences on what would otherwise be a steady voltage, but such an hour with the oscillograph will give one an insight into the peculiarities of an alternating current circuit that can be obtained in no other way. In fact, the oscillograph, in this particular case, showed that even direct current, simple and innocent as it is supposed to be as compared with the mytseries concealed under the name of sine wave, has its own peculiar troubles, as was evidenced by the horribly distorted diagram shown by Mr. Price as a true copy of the kind of direct current produced by a mercury rectifier. The paper was given in the regular meeting room, which, as the apparatus, outside of the oscillogar phitself, was all some distance away in another building, involved quite an elaborate system of operators, along with telephone communication between them and the lecture room. Notwithstanding this handicap everything went off very smoothly, the paper undoubtedly proving one of the most interesting of the whole Convention.

It is, of course, impossible to give a description of the instrument in the space available, except to say that it consists of a galvanometer having a moving part of such extraordinary lightness and sensibility that it readily follows any and all of the instantaneous variations in any kind of current. This is the basic feature of the instrument, the other auxiliary parts being an arc lamp to produce the light which is reflected by the

galvanometer mirror, and which is what the observer really sees, a little motor for driving the various moving parts, prisms, ground glass screens or photographic plates, etc. By means of the complete instrument a spot of light reflected from the mirror, which latter is swung one way or the other and to a distance exactly corresponding to the direction and strength of the current under observation, is made to trace its path on a ground glass screen. The motion of the spot is, of course, exceedingly rapid, so fast, in fact, as to produce the effect of a line instead of a spot, just as a torch, if swung rapidly in the air, loses its own identity as a relatively small point of light, the eye seeing only the circle or other figure which marks its path. The line thus produced by the oscillograph spot is an exact reproduction of the shape of the wave which is actuating the mirror, a permanent record of it can be obtained by substituting a photographic plate for the ground glass screen, or it can be sketched by throwing it on to tracing cloth.

The lecture given by Mr. Price very clearly demonstrated the abilities of this most interesting instrument, the results at times bordering almost on the uncanny as one wached the workings of the internals of two alternators that had just been paralleled. The effect in this way was painfully like an X-ray investigation, in fact, Mr. Price explained to his audience that the oscillograph could be arranged so as to record breathing and the beat of the heart. The delegates to the Convention are to be congratulated on having had such a good opportunity of seeing it at work, each one who was present doubtless now appreciating more than ever the possibilities contained in the old familiar expression, "out of phase."

Light and Illumination

For all ordinary conditions an illumination of one candle foot is generally satisfactory, though the surrounding colors and the duties to be performed naturally affect this very much. One-half a candle foot is about the minimum that is necessary for almost any kind of work, while two candle feet will as a rule give excellent lighting for everything except the finer mechanical arts, such as watch and instrument making, draughting, etc., though in this connection it should be noted that the human eye will work quite satisfactorily over a very wide range of illumination, providing only that the changes from one intensity to another are not made suddenly. The reason for this inability to see satisfactorily under quick changes of light is that the iris of the human eye is a slow moving mechanism, quite unable to respond to any but comparatively slow changes in illumination, and in this way admitting far too much light when one first goes, say from a cellar into the garden, or conversely, not enough when one first enters a dark room after having been in bright sunlight. Hence the blinding sensation experienced in the first case and that of almost total darkness in the other. Nevertheless, give the iris time to act, "let our eyes get accustomed to the light," as we commonly say, and we see fairly well even in the cellar, notwithstanding that the illumination there be but one-fiftieth or one one-hundredth of that outdoors.

This slow movement of the human iris is also the explanation of the very injurious effects of flickering lights. A flickering light is, of course, simply one which varies rapidly from one strength to another, consequently when working under such conditions the iris is kept in a continual state of unrest trying to follow the change. The inevitable result of such unnatural conditions must of necessity be tired and irritated eyes, to say nothing of the permanent injury which will in all probability be the result of their continued use under such faulty illumination.

Another factor which affects proper illumination is what is known sometimes as the luminous intensity, or more frequently, the intrinsic brilliancy, of the source of light. This, as the name implies, is a measure of the amount of light given out per unit area by any light-producing source, and is generally expressed in candle power per square inch. It varies very much in different lights, an unshaded Nernst lamp giving about 1000 c.p. per sq. inch, a clear 3½ watt incandescent about 250, the same lamp frosted about 3 or 4, and the Tungsten lamp, say 700. High intrinsic brilliancy is very much to be avoided because of its injurious effect upon the eyes, hence the desirability of frosting even an ordinary incandescent lamp, to say nothing of the Tungsten, and hence also the use of an opal globe on Nernst lamps. This latter, in fact, is almost a necessity, due to the very high intrinsic brilliancy of that illuminant, which is exceeded only among natural lights by the sun, and by the open arc and calcium lights among the artificials.

High intrinsic brilliancy also has another very marked effect, and that is that it tends to deceive the eye as to the amount of light emitted. This also is very clearly evidenced by looking at a Nernst lamp, which to the ordinary observer appears to be exceedingly bright and therefore of very high candle power and efficiency, while as a matter of fact it is not quite as efficient as a 2½ watt incandescent. Then again take a 32 c.p. street series incandescent lamp and compare it with the ordinary 32 c.p. multiple type, the former will always look to be much brighter, due to the more concentrated form of its filament, and will in this way nearly always deceive the average observer, the effect being equivalent to greater intrinsic brilliancy.

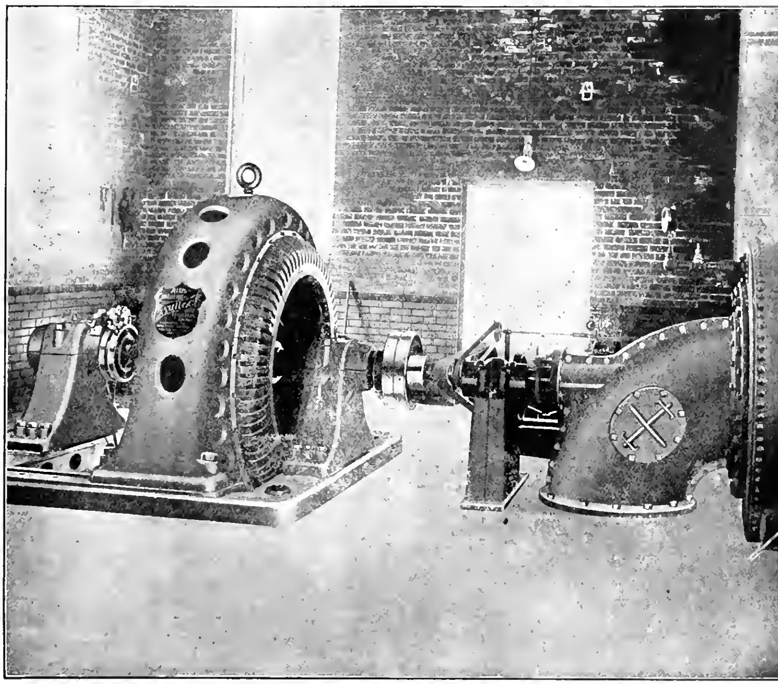
As a result of the effort to get away from the bad effects of high intrinsic brilliancy, various diffusers have been put on the market, and are largely used by those who appreciate the important points involved. Their employment, of course, entails some slight loss of light, but as against that they allow the satisfactory use of illuminants which otherwise would be highly injurious to the eye, besides not giving satisfactory illumination. The explanation is that without them the spaces immediately surrounding the lamps are very much brighter than other parts of the room, and as the human eye always adjusts itself to the brightest spot within its range, all the rest of the surrounding space naturally looks dim. With the diffuser, however, and its equalizing characteristics, these very marked contracts are removed, and the result is good illumination.

The people of Brantford, Ont., have just finished raising the sum of $40,000 for a memorial to Prof. Alexander Graham Bell. It was just outside of the city that Prof. Bell made his first successful experiments with the telephone, and Brantford has ever since been known as the "Telephone City." With this money subscribed several blocks of land in the centre of the city have been purchased and will be turned into public parks. In addition a monument will be erected to perpetuate the name of the inventor.

Amiot & Dufresne, electricians, Three Rivers, Que., have registered.

Gravenhurst Power Plant.

Gravenhurst, Ont., is one of the many enterprising municipalities which have built electric light and power plants of their own. The power house is at South Falls on the Muskoka river eight miles from the town. The generating plant, a view of which is here given, consists of a waterwheel type alternating current generator, 450 kw., 60 cycle, 3-phase, 6,600 volts, 600 r.p.m., built by Allis-Chambers-Bullock, Limited, of Montreal. The exciter, a 15 kw. direct current generator, is belted to the main shaft. The waterwheel develops 750 h.p. under a fall of 102 feet. The contract of Allis-Chalmers-Bullock, Limited, also included switchboard, transformers, and other auxiliary apparatus. This neat and complete plant is in charge of Superintendent E. Smith.



Gravenhurst Power Plant at South Falls, Muskoka River.

British Columbia Railway Extensions

General Manager Sperling of the British Columbia Electric Railway Company has announced a number of developments which the company proposes for next year. The expenditure of the sum of $4,280,000 has been authorized by the board. A large freight shed will be erected west of Carroll Street, adjoining the property of the Royal City Mills. This will be for handling traffic on the Lulu Island and New Westminster interurban lines. These sheds will be commenced at once and probably be completed in three months. A central passenger station and office building three stories high, costing $200,000, will be built at Carrall and Hastings Streets. Provision will be made for increasing it to five stories when necessary. The ground floor will be a passenger station and the offices will be in the upper stories. Work on the building will begin next spring and occupy about twelve months.

On the New Westminster-Chilliwack extension contracts for 38 miles have already been let. The remaining 24 miles will be contracted for as soon as the work on the Sumas dyking scheme has advanced to a proper stage. The final tenders for the electrification of this line, which will probably be the largest contract the company have ever awarded, have now been received and announcement will be made shortly as to the award. Both Canadian and British manufacturers have entered the field for this work.

As soon as the C. P. R. have finished laying the rails on the New Westminster-Eburne line the B. C. Electric Railway Co. will take it over and electrify it. A proposal is almost completed for extending the Vancouver city lines east of the city boundary and a number of extensions are proposed also in South Vancouver.

A formal petition may go to the Ontario Government shortly from the officers at Osgoode Hall, asking that individual telephones be installed for the more convenient transaction of public affairs. Osgoode Hall equipment is not that of a modern business office, though it is a little better than it used to be.

"The Barber Electric Co., Limited," has been incorporated in Vancouver, to succeed the A. F. Barber Electric Company.

European Hydro-Electric Power Development

Interesting paper read before the Canadian Electrical Association by C. H. Mitchell, C. E.

Canada's wealth in water powers is an asset to be seized upon and developed to the utmost advantage according to the expansion of the country. Recognizing such opportunity, or rather necessity, Canadian engineers entrusted with this development, naturally seek much inspiration abroad, especially in those countries which, historically at least, have led in their branch of work. Notwithstanding the many conditions peculiar to this country, especially that of climate, labor and of industry and commerce generally, the basic principles

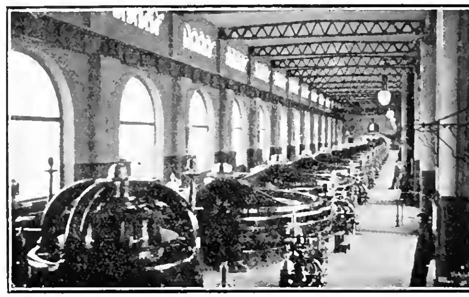
Chevres: General View of Station.

of the design, construction and operation of hydro-electric power plants are much the same as in Europe.

Viewed from the hydro-electric standpoint of engineering, Central Europe undoubtedly has led all other portions of the world, and it is there the engineer must go, even to-day, to obtain ideas as far ahead of America as are the European fashions. Switzerland is to the hydro-electric engineer what Paris is to the engineers of fashion.

It is not the least surprising that Switzerland, Northern Italy, Eastern France and the Austrian Tyrol should have attained this distinction, because they have grown into it by sheer necessity. These regions do not contain a pound of coal or other fuel in quantity, and it was to be expected that to the glacier fed streams and waterfalls the manufacturer and engineer would turn for his power. The result of this has been the gradual development of the hydraulic turbine, the in-

Chevres: Interior of Station.

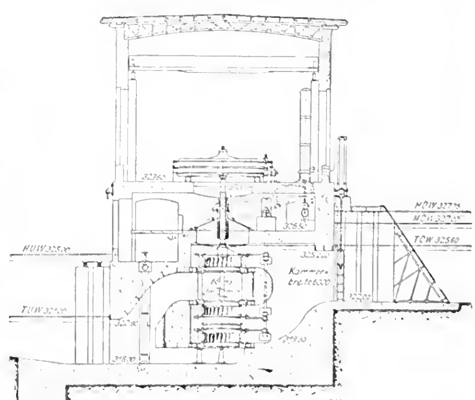


Beznau: Interior of Generating Station.

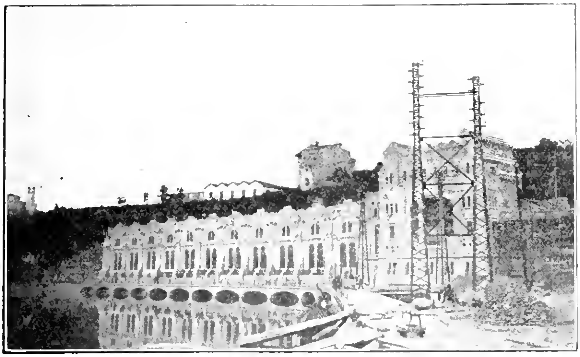
crease of its efficiency and the introduction and adoption of ingenious methods of application and control of water. And when electrical transmission became a settled factor, these countries were quick to seize upon its advantages in conjunction with their hydraulic works, with the result that in many respects they are, and continue to be, several years ahead of their competitors.

Through such means the design and the excellence of the hydraulic equipment manufactured in European shops and installed in their operating plants have reached a quality and an efficiency to which American builders have not yet, or only recently, partly attained.

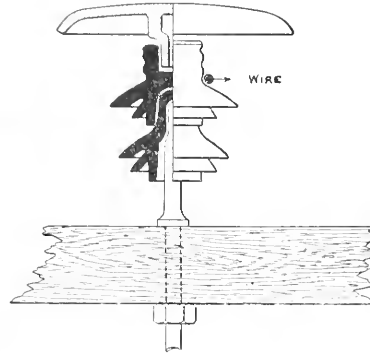
On the electrical side, however, the conditions, the writer considers, are reversed and it seems to be generally admitted that American design and construction are to the front. There are, nevertheless, many points in the European systems with which engineers on the American side of the water might do well to familiarize themselves. Among these might be noted the wide power distribution features, the great attention to detail, both technical and commercial, the very general use of small motors in what in many cases are almost



Beznau: Section through Unit.



Trezzo: General View of Generating Station.



Trezzo: Semenza "Umbrella" Insulator.

household industries, and the popular education which has been directed by the Governments and power companies, looking to more universal use of electric power.

To present in such limited space any adequate description of typical installations in the several countries named would be well-night impossible, and it is the purpose of this paper to rather indicate some of the interesting features, both hydraulical, mechanical and electrical, in a few of the more important and recent plants.

In all the installations indicated there is indeed a great similarity in many of the electrical features, more especially because it is only very recently that long distance, high tension transmission, as we know it in this country, has been attempted. On the hydraulic side there is great dissimilarity, and on this account the many installations naturally fall into several distinct classes. The simplest division is with relation to the hydraulic operating conditions, which for convenience have been divided into low, medium and light heads.

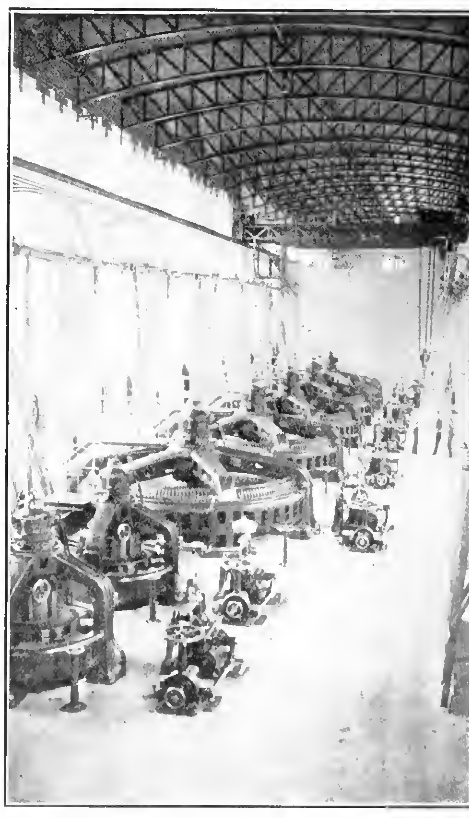
LOW HEAD PLANTS.

Low head plants as now designed in Europe are not comparable with those of twenty or even ten years ago, nor with the practice still prevailing in America. Water, the invaluable asset, is too precious to the European to allow any waste, such as even now is common in plants on this side of the ocean. To deal with large quantities of water as are involved in low head propositions has required bold design and bolder financing to obtain every foot-pound of energy throughout the year. Nowhere have more ingenious devices been employed to meet abnormal fluctuations in the level of head and tail water under low heads than in Switzerland, and from an hydraulic point of view this is the leading feature in the following.

Chevres.—The Chevres plant is situated on the River Rhone, three miles below Geneva, Switzerland, and its history reads almost like an engineering romance, so various have been the changes and evolutions effected since its first construction in 1890.

In general the power works consist of a main dam provided with sluices for immediate control of head water, an entrance canal and intake service extending upstream from the dam and a generating station parallel to the river, extending down stream, having the water introduced on the shore side of the house. The sluice weir has six gates of the Stoney type, each 33 feet wide and 28 feet high, built between piers, each of which is 56 feet long and 10 feet thick. The Stoney gates are of structural steel, counterbalanced and actuated with small hoists located on an overhead bridge, so adjusted that two men can raise or lower them by hand. Each gate weighs fifty tons and has three hundred and sixty tons against it when closed.

The dry weather flow of the Rhone at this point



Trezzo: Interior of Station.

is about 1,200 sec. feet, occurring in winter, at which time there is a head of 28 feet; in summer the flow is as high as 32,000 sec. feet, when the head is reduced to 15 feet, or almost half.

The generating station is 450 feet long, and 41 feet wide, and accommodates 15 vertical type power units and three exciters, as well as a complete oil pumping and filter plant, a workshop and offices. All the building foundations and other works are built of concrete, resting upon sandstone ledge.

Ten of the turbine units are comparatively modern and have four runners; of these five are for the low summer head, and five for winter or high head.

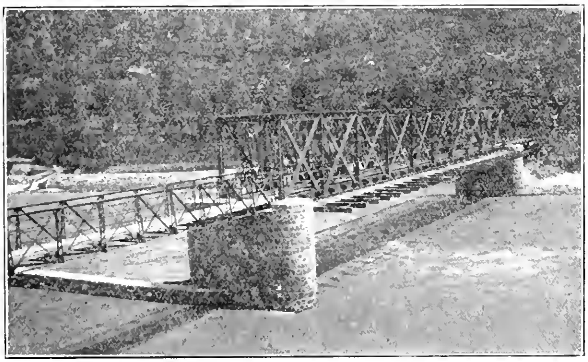
With five turbines of earlier type, however, when there is a high head, that is, when tail water is low in winter, only the lower pair of runners is in operation, which when full open, develop 1,200 h.p. at 80 r.p.m. In summer, with high tail water level and low head, both pairs are in operation, when each delivers 400 h.p., or 800 h.p. together.

A peculiarity of these turbines is in the method of governing by a hydraulic servo motor, which provides that when the upper pair of wheels is not working, only the lower gates are operated, and when both pairs are working, regulation is obtained by the gates of the upper pair only.

The electric generators installed at the different times are of the same general umbrella type, but are of various windings. Eleven units are two-phase, 750 kw., 2,750 volts at 45 cycles, five of which (earlier) have fixed fields, and six have revolving fields. Three units are 2-phase, 5,000 volts, and one is a D. C. machine of Thury 12 pole type, supplying current to an electro-chemical works nearby at 208 volts.

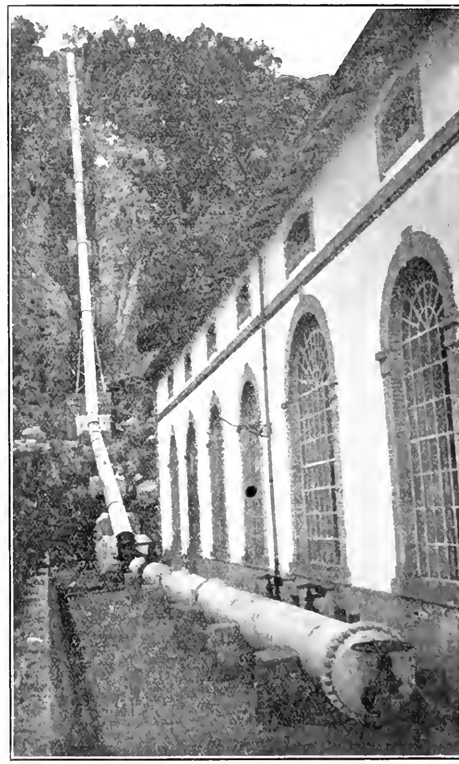
Perhaps the most remarkable features of this plant are in connection with the distribution and the large ratio of consumers to population served. The very general use of current in Geneva was evident in a short trip made by the writer, in company with the engineer, when a planing mill, a bakery, a jeweller's, a printing office and a chocolate factory were visited, in which from 2 to 15 h.p. were used. The large number of takers under 2 h.p. was astonishing, and it may be noted that 113 of these small takers at 10 volts were using only 50½ h.p. altogether, while 189 at 500 volts were using 1,261 h.p. at the end of 1905. The average power of all motors was 1.2 kw. The total number of incandescent lamps in service at that time was 85,000. For the distribution of this power to 27 city and suburban localities, 698 transformers in 83 sub-stations are required, being the largest number of any plant in Switzerland.

Prices charged by the city of Geneva are as folows: For lighting, 16 c.p. lamps (70 watts), one cent per hour, with a large discount for a considerable number of lamps. For power, on flat rate, 1 h.p. at $64 per h.p.



St. Maurice: Adjustable Head Dam, Rhone River.

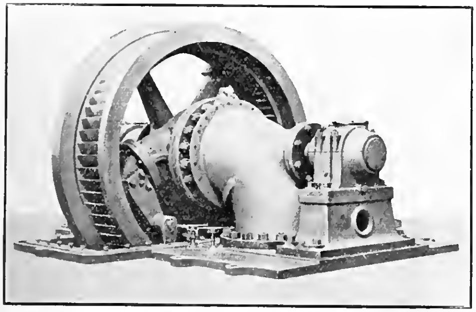
St. Maurice: General View of Power Station.



Olevano: 40-inch Penstock, 960 ft. head.

year, 10 h.p. at $43 per h.p. year, 20 h.p. at $32 per h.p. year, 50 h.p. at $28, and 100 h.p. at $22.40. These figures are based upon a ten hour day, with full advantage of the discount. A 24 hour day would increase the amounts by 50 per cent. Coal for steam power is about $7 per ton.

Beznau, River Aare.—One of the most interesting low head plants in Switzerland to-day is that situated on the Aare River, the Beznau Station. In it are constituted all the most recent improvements in the application of the water to the wheels, and in the wheels themselves are embodied the results of the experience of the past ten years, with plants operating low heads with large variations. This plant was completed and put in operation in 1904, and was quickly loaded up with consumers in the surrounding country.



Olevano: Impulse Wheel, 1.200 H.H. showing Nozzles, (case removed.)

The available fall varies between 10 and 15 feet, and, owing to this variation, the vertical turbine units consist of three runners 7 feet 6 inches diameter. One pair of runners is at the bottom, right and left, and the third above, discharging downwards into the draft chamber of the upper runner of the pair. At a medium head of 13 feet 1,000 h.p. is obtained on each unit at 67 r.p.m., using 890 sec. feet of water. The whole unit is supported by hydraulic pressure beneath a disc, so as to reduce the weight on the step bearing, and the small inequalities of this are further balanced by oil pressure from special pumps.

The power secured in these units varies between 7,000 and 11,000 h.p. for the whole installation of nine units.

The generators are of the umbrella revolving field type, 800 kw. each, 3-phase, wound to 8,000 volts at 50 cycles, and were built by Brown, Boveri & Company, of Baden. Local distribution is at the generating voltage, while long distance is at 25,000 volts up to 20 miles. The latter voltage was the highest in transmission operation in Switzerland at the end of 1905. The total length of transmisison lines of this plant in 1905 was 70 miles, the number of localities served was 61, the population 250,000, the number of transformers 60, and stations 31, while the average power of motors served was 100 kw., in which respect this plant stands third in the country.

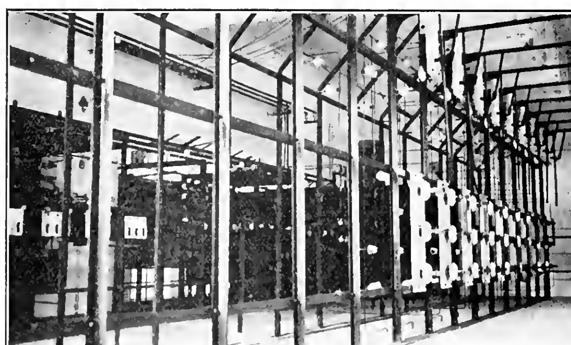
Prices of power are generally as follows: For lighting, 16 c.p. lamps, $4 each per year, continuous service. For motors on 10 hour basis, flat rate, 1 h.p. at $43, 10 h.p. at $39, 50 h.p. at $34, and 100 h.p. at $32. For 24 hour basis, 1 h.p. at $56; 10 h.p. at $49, 50 h.p. at $44, and 100 h.p. at $41.

Trezzo, Adda River, Italy.—The Trezzo plant is one of a series owned by the Edison Company of Milan, and has only been recently put in operation. The Adda River at this point (25 miles northeast of Milan) makes a horseshoe bend around a rocky hill, and the power project consisted of draining the river at the crown of the bend and placing the power house alongside of the rock cliff, discharging the water from the tail races through tunnels under the hill to the river below. The low head thus obtained, only 24 feet, required vertical shaft type of units with low speeds and a corresponding large volume of water with many units.

Against the high cliff of the river, in the horseshoe, the power house was constructed, having its face parallel to the river flow opposite, yet almost square against the current on the approach to the curve; this arrangement provides ample water with minimum deflection, and at the same time produces a sweeping current to carry past debris, etc. The station is situated about 300 yards upstream from the sluice gates of the dam, and is a large and very handsome structure built entirely of stone.

It will be seen in the illustration that there are ten main water entrances, each 22 feet wide, and two exciter inlets. These represent as many units and the water in each, after passing screens and gates, enters a wheel pit with its vertical turbine, thence into the tail pit and common bay, about 300 by 60 feet, in the rear of the station. From this point the water is conveyed by means of two tunnels beneath the cliff to the lower river. For a distance of 150 feet above the station and in continuation of the face of the water inlets, a series of ten overflow weirs is arranged to take care of slight inequalities in the river level.

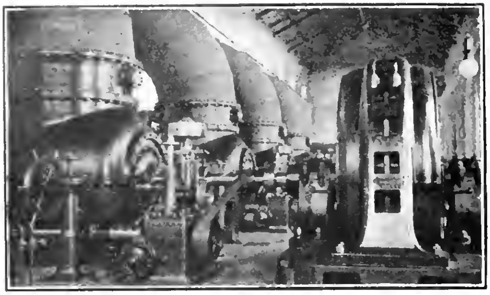
The vertical turbines are Francis type, each of



Olevano: High Tension Switches, (30,000 Volts.)

1,500 h.p. capacity at 105 r.p.m.; the first six and the two exciter units are by Riva Moneret & Company, and the seventh is by Escher, Wyss & Company, of Zurich. Considerable use has been made of reinforcing steel in the concrete foundations and settings of these machines. The governors are connected by two stems to the gates. The generators are of 3-phase revolving field type, two at 50 cycles, and the remainder at 42 cycles, and are built by Gadda & Company, Milan.

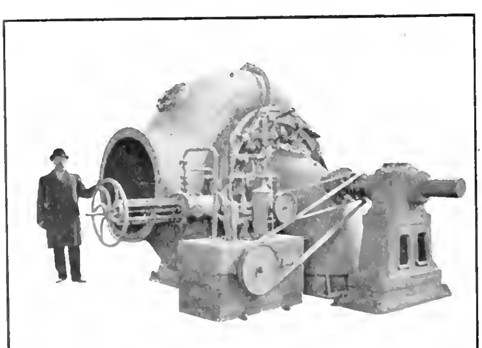
In the arrangement of switches, transformers, arresters, instrument boards, control, etc., this station is very complete and roomy, and the whole large wing at the end of the station is occupied by this apparatus. The distant control apparatus is, in itself, a very perfect



Vigevano: Interior of Generating Station.

arrangement, permitting complete operation from table switchboard to isolated apparatus in different compartments of switch and transformer rooms.

Four transmission circuits, three to Milan and one to Bergamo, are now in operation at 13,000 volts, carried on structural steel towers, known as the "Elastic" type. The function of these towers is that while rigid at right angles they will oscillate slightly in the direction of the line, creeping of the cables being prevented by guying at intervals. These towers are 40 feet high above the ground, built with two legs (channel section) 7 feet apart, and each leg set in concrete 5 feet deep; the top of each leg member carries two circuits. Insulators on these lines are of the Paderno type, but are being partially replaced with a new design recently patented by Signor Semenza, consulting engineer of the company. This is a radical departure, but most simple, with qualities of insulation which are obvious. The design, which can be better illustrated than described, consists of the lower portion of a simple Paderno insulator, provided with a threaded top and side groove in which the wire passes; over the top is screwed an "umbrella" made of terra cotta about 12 inches in diameter. It is interesting to know that in the breakdown tests on this insulator, designed for 30,000 volts, the ratio between wet and dry conditions is nearly unity, viz., 122,000 volts for dry and 110,000 volts for wet. A feature of this new type is its small cost, the inexpensive, large upper part of the usual porcelain insulator being replaced by a simple, easily formed piece of terra cotta or other cheap material. As jokingly pointed out by Signor Semenza, a new umbrella is, in this case, cheaper than an extra petticoat.



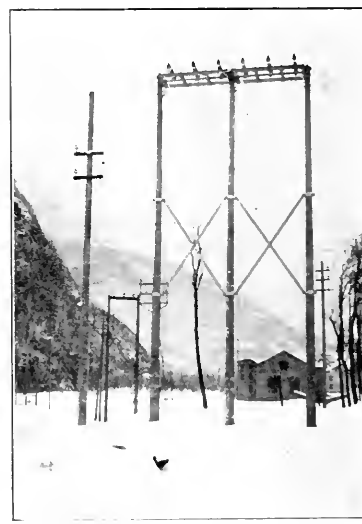
Gavet: 2,000 H.P. Spiral Francis Turbine, 190 ft. head.

MEDIUM HEAD PLANTS.

There is perhaps not a great deal to be noticed in the plants of medium heads, say between 40 and 100 feet or more, as they are generally of types similar to many American installations. Two plants, however, have been chosen for particular features, which are especially interesting to electrical engineers.

Vigevano Plant, near Milan, Italy.—Milan, which may be said to be the electrical city of Central Europe, is developing such a tremendous business in power that the actual supply has been quite behind the demand, and the result is that the electrical companies in the field have been using every means to increase their output by the exploitation of new hydro developments.

The new installation at Vigevano, on the Tessin river, 20 miles west of Milan, is a recent result of overburdened generating stations, and was placed in operation in 1906, and illustrates one of the latest types of hydro-electric stations to be adopted by Italian engineers.



Gavet: Wood-Concrete Encased Poles.

Water for this plant is brought through canals three miles, to a fore-bay above the power station, having an overflow, screens and inlet sluices, to the steel penstocks, which are 6 feet 6 inches diameter, one for each unit. The penstocks are about 200 feet long and enter through the station wall into the tops of the wheel cases. As a generating station, the arrangement of this plant is ideal, and upon entering the visitor is impressed with the convenient and roomy arrangement. The turbine and generator units, five in number, are arranged abreast in a long hall, the two exciter units being at one end. At the same end is the switchboard, mounted on, and under, a floor, which is 6 feet above the main floor; the whole hall is about 340 feet by 40 feet. Alongside the gallery is an enlarged wing, containing all switching and transforming apparatus, the arrangement of which in convenient sequence, roomy spacing and isolation is very clever. In the introduction of these features the European practice in design within the past two years is quite marked.

The turbines are by Riva Monneret & Company. Milan, four units being installed at the time of the writer's visit on February 6th, 1906, and one being still in the shops. The type is horizontal shaft double Francis inward discharge, into a draft chest: the cases are exposed and form the termination of the penstocks. Each turbine unit works under a head of 61 feet, developing 1,400 h.p., using 270 cubic feet of water per second. The governors are of a special oil type, recently perfected by the turbine makers, sensitive and very powerful for their size; the writer looked at the governors, especially to discover periodic hunting, while the station was running in parallel with a steam plant at Milan, but could see no injurious irregularities. The generators, by Gadda & Company, Milan, are directly conected, 3-phase, wound to 2,750 volts at 42 cycles.

Switch gear is fitted with table instruments and distant control apparatus, so that the operators can at once see both instruments and machines. Current is stepped up to 25,000 volts and the transmission lines, comprising two circuits of 7 mm. wires, are caried on steel towers spaced 350 feet apart.

The power from this station is used in outlying towns to the north and west of Milan, as well as in the city.

The prices obtained by this company in the widely separated centres of consumption are based on a flat rate, and on a 24 hour day, average about \$31 per h.p. year, with a minimum of \$23 and a maximum of \$44, depending on distance. The price of coal is about \$7 per ton.

St. Maurice Station, Switzerland.—The St. Maurice-Lausanne installation, generating power from the Rhone east of Lake Geneva, and transmitting by direct current to Lausanne, 35 miles distant, has become world-famous as being the pioneer D. C. transmission system in commercial operation under the Thury patents.

Not only are the electrical features novel, but the hydraulic arrangements are also most unique, especially in the head works and in the hydraulic governors.

The Rhone is subject to great fluctuations in this region, being essentially a torrential river, and in the late summer and winter periods the flow runs to such a minimum that it is necessary to use special means to divert the water into the head works. For this purpose a permanent dam not being permitted or advisable, a device was resorted to whereby a moveable dam structure is let down into the river from an overhead bridge. The bridge is a steel Howe truss on stone piers; from the floor is suspended a series of hinged frames which can be lowered so that their lower ends rest in seats in the river bed. These frames are then filled in with wooden stop logs to the desired height to divert the water to the inlet of the head canal alongside.

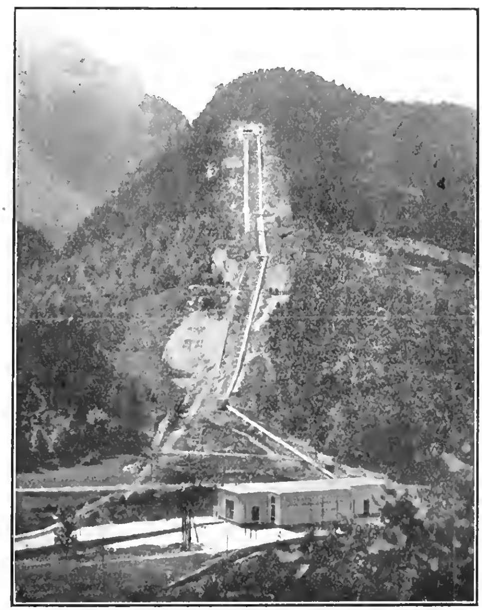
From the intake, water is conveyed by open cut and closed conduits, nearly two miles, to a forebay above the power station, whence three penstocks of 8 feet diameter, and about 1,500 feet long, lead to the turbines.

There are at present five power units in this station, each nominally 1,000 h.p. The turbines working under 110 feet head are of the Francis type horizontal shaft, with snail shell case, running at 300 r.p.m. Water is introduced from beneath the floor from the penstocks. Each turbine operates two direct current generators, and all five turbine units are governed in parallel from one governor, specially designed for this purpose.

The ten generators are of a special Thury type, giving 150 amperes at 2,300 volts. Connected in series the ultimate line voltage becomes 23,000 volts, and is transmitted over two wires to the step-down or distributing station in Lausanne, where by series motors the current is taken off to the secondary outlets. The electrical portion of this plant has been so often described in the technical press, especially the past three years, it is not the intention here to do so further. There are features of D. C. transmission and operation, however, which might be mentioned as of interest.

It is claimed for the Thury system that while the generating apparatus is much more costly than for alternating current—as much as 75 per cent. in excess—the switching gear and transformers, and buildings therefor, necessary for the alternating system are absent in the direct current system; the total result being a cost very close to or perhaps less than the alternating.

In the transmission line, however, a great saving of



Vallorbe: General View of Station, 770 ft. head.

first cost and operation exists, owing to cheaper insulators, less copper, smaller spacing of circuits on poles, cheaper and simpler lightning protection. The actual experiences with lightning in operating D. C. and A. C. transmission systems in France and Switzerland has, the past two years, been much in favor of the D. C. The St. Maurice-Lausanne line, which has been in operation for five or six years, has seldom had a shut down due to lightning, and as this line and the new Moutier line, also singularly free, are in the Alps, where lightning disturbance is at its worst, it is claimed that their immunity from trouble has been entirely due to the system.

HIGH HEAD PLANTS.

High head power installations are rapidly becoming the most numerous and important types in the Alps, for the generation of power. Certain localities in

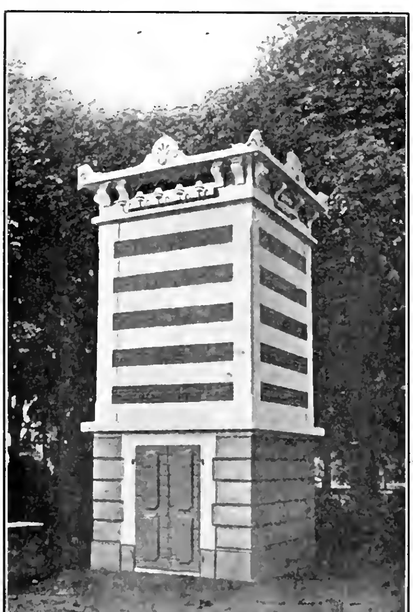
Switzerland have been specially developed in this respect, but there are also many such plants in the Alps, in France, Italy and Austria, as well as in other portions of the continent, especially where expensive fuel and a transmission market has offered remunerative investment.

Without enumerating the many plants, especially in the Central Alps, varying in head up to, in one instance, 3,140 feet, near Territet—the highest in the world—the writer has selected a typical new Swiss installation, a new French plant in Savoy, and an Italian one south of Naples. Each of these has special features of interest.

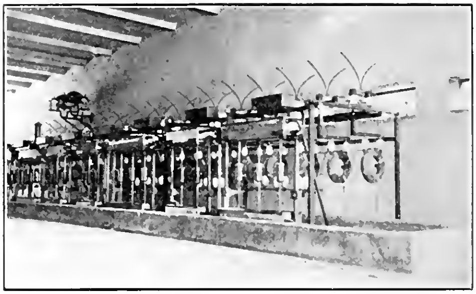
The Olevano Plant, Near Naples, Italy.—The Olevano installation is on the Tusciano river about 50 miles south of Naples, has a capacity of 6,000 h.p. and current is transmitted to various towns en route to Naples, passing Vesuvius at its base. Its transmission lines suffered severely in the recent eruption. The uses are mainly for lighting and mixed power in small units, such as for fabric and textile weaving, machine and woodworking shops, but more than all for the macaroni factory, which is the flour mill of Italy.

The head water is brought about three miles by canal and tunnel to a forebay on the mountain side, thence down to the station in a steel penstock, forty inches diameter. There is now being used only about 70 sec. feet of water, under a static head of 960 feet. The penstock is about 2,000 feet long and is carried down the mountain on 65 concrete saddles. The lower end is horizontal and distributes to five power and two exciter units. The upper portion of the penstock is of 1/4 inch steel and the lower 3/4 inch.

In the generating station the five units at present installed are each of 1, 200 h.p. output capacity. The waterwheels are of a special horizontal shaft, impulse type, manufactured by Piccard Pictet & Company, Geneva, Switzerland. They are rated nominally at 1,400 h.p., run at 500 r.p.m., and each uses about 14 cubic feet per second of water. The runner, 4 feet 8 inches diameter, consists of two heavy cast iron rims, having the steel vanes set between; this is mounted in a spider attached to the shaft. The water is introduced through a pair of nozzles at 90 degress with each other, which are formed in one casting bolted to the end of the supply pipe; the nozzles lie up to the inner periphery of the runner and the latter discharges outwards similarly to the Girard turbine. The discharged water is caught in tail pit below and the whole (pit and runner) is covered with a casing. The nozzles are opened and closed by a bronze tongue or throttle deflecting within the opening on a shaft which is linked up to the governor.



Vallorbe: Artistic Transformer House.



Vallorbe: Water Resistance Lightning Arrester.

In the earliest nozzles on this type of wheel, the manufacturers had formed the whole nozzle head and tongue of bronze, an expensive feature in large units, especially when renewals are frequently required. Later types, however, such as the present, are built merely with bronze lips and tongue, as it is found that these—especially the lips—are cheaply and quickly renewed. The writer saw and obtained a photograph of the eroded nozzle from one of the wheels in this installation, which had been in use 12 months; it presented a good object lesson of the power of sanded water under high head, which forms one of the difficulties to be met with in the operation of this plant. It is to be noted that there is comparatively no erosion of the vanes of the runner under these conditions.

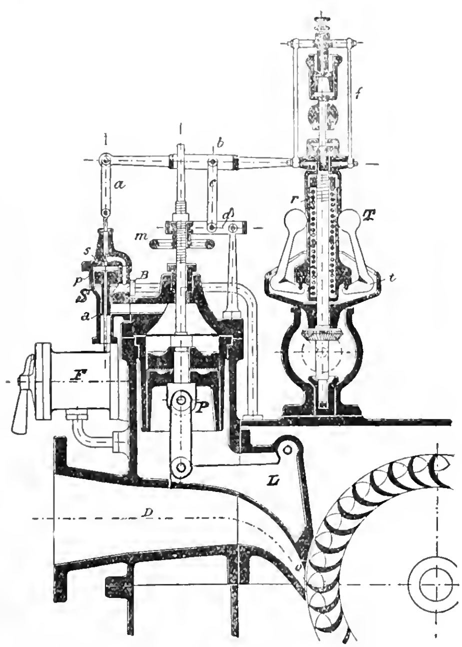
It is stated that in tests on these hydraulic units by the company, the following efficiencies were obtained: At full gate, 76 per cent.; at three-quarter gate, 73 per cent.; at half gate, 68 per cent.; at quarter gate, 62 per cent. The generators and electrical apparatus made by Westinghouse present no especially new features beyond the general modern practice of switching and isolation as designed by that house. The generators are three-phase, wound to 3,000 volts, and static oil-cooled transformers step up to 30,000 volts to the line, consisting of two trunk circuits which are carried on one line of structural steel poles about 180 feet apart. The wires are 7 mm. copper, and are 24 inches apart.

Prices for power in the cities named vary according to amount and distance from generating station. At Salerno, 16 miles distant, 200 h.p. is sold for \$25 per h.p. year, on a 24 hour basis; larger blocks of power are sold nearer Naples at \$30 per h.p. at 24 hours. There are two consumers near Naples using 800 and 1,00 h.p. each. Coal at Naples is about \$8 per ton.

Gavet Station, French Savoy.—This installation is

situated on the Romanche river, and is in the heart of the French Alps. The distinctive features of this river are remarkable, for its flow is very small, being in dry weather only about 300 sec. feet; while the flood discharge is thirty times as much. Its descent is very rapid, hence high heads prevail, and in the seven plants installed on twelve miles of its course 40,000 h.p. is developed. This river offers a notable example of the utmost development of mountain streams for power generation.

The power is used for numerous electro-chemical industries, including calcium carbide works, and especially the "electric-steel" works of Keller, Leleux & Company at Livet. At Livet is also located the municipal plant for Grenoble. A transmission line from the latter, 24 miles long, to Grenoble, has a considerable portion carried on wooden poles incased in from 1 to 2 inches of concrete. Unique as this is, it appeared to have given fair satisfaction in the three years' operation before the writer saw it.



Vallorbe: Section through Hydraulic Governor.

The Gavet station, completed in 1906, is 16 miles from Grenoble and has an output of 5,000 h.p. at the lowest stage of the river. The head works are very ingenious, having besides the dam, several weirs and settling basins for the purpose of freeing the water of gravel, sand and silt, which is carried in great quantities in mountain streams. The flume or tunnel to the power station is 7,000 feet long and about 10 feet square.

The tunnel terminates in a small covered forebay high up the face of the cliff above the station, having outlets for two penstocks and one spillway. The penstocks follow down the cliff, and are 7 feet diameter, about 500 feet long, and each branches to the three main and two exciter units at the rear wall of the station.

The station is of rubble stone, having a generating room, commodious switchboard gallery, wire ducts, transformer and arrester rooms. The writer had the pleasure of visiting the plant on February 14th, 1906, with the consulting engineer, M. Boissonas, of Geneva, who pointed out many of the new features.

The turbines develop 2,000 horse-power each, working under a head of 190 feet; they are of the horizontal shaft, single spiral Francis type, built by Piccard Pictet & Company, of Geneva. The distributor gates are swivel style, with an actuating gates ring carried on arms fitted with springs, to positively take up lost motion. The governors are by the same makers, arranged with a new device on the fly balls, to stop petty vibrations. The main shafts have flywheels and Zodel flexible leather link couplings.

The generators are by Schneider & Company, Champagne, revolving field type, three-phase, 4,000 volts, 231 amp. per phase. The transformers step up to 26,000 line voltage the same as at the Avigonet station, with which this station will at times be run in parallel, 24 miles distant. The line is at present carried on wooden poles.

Good quality steam coal in Grenoble costs about $5 per ton. The prices of the Societe Grenobloise are, in general, as follows: For 24 hours' service the average prices (variable on account of distance) are, say for 100 h.p., $30 per h.p. year, and for 500 h.p. about $26 per h.p. year. In 500 h.p. quantities prices run down as low as $18 for transmitted power and even to $12 at the station. This company has now 15 year contracts for about 15,000 h.p., with some customers 100 miles distant.

Vallorbe Development, Switzerland.—Vallorbe is a small city in Canton Vaud on the Orbe river, north of Geneva, and two miles from the French frontier. The river empties from Lake de Joux, which is 800 feet above the valley, through an underground passage, and commences its course as an open river from a gigantic bubbling spring.

The Vallorbe plant has been in operation since 1904 with five units; space and connections are arranged, however, for three more, while ultimate extensions will provide for a total of about 12 units if sufficient water can be secured. The present output of this plant is 5,000 h.p.

Hydraulically this development is most remarkable, owing to the nature of the water supply. Lakes de Joux and Brenet have six and seven surface outlets respectively, but the main discharge is the subterranean river, which forms the Orbe. In order to get sufficient water, then, all the small surface outlets were dammed, and the lakes were formed into a huge reservoir, in which the concessions permitted the fluctuation of the level within the limits of 12 feet, artificially controlled. At certain periods of the year these lakes have regularly risen a number of feet, according to a law determined by observations extending over many years. This increase is now partially secured by the new works, and is held up for power purposes. The subterranean flow, however, still proceeds. Hence the development presents the unique feature of being dependent entirely on storage water or such as can be stolen from the natural outlet.

The water taken at the intake in the lake, after passing racks and gates, is carried by means of a rectangular concrete lined tunnel to a point on the lower hillside, where a forebay and head house are

located. The tunnel conduit is 6 feet 6 inches wide, 7 feet high and about 8,700 feet long.

The forebay works can be seen high up the mountain side. Water issuing from the tunnel first passes a coarse rack, enters a chamber having an overflow weir with adjustable crest, thence passing head gates enters the penstocks. Overflow water spills into a large chamber from which steel pipes carry it down the slope. The penstock varies in diameter from 48 inches at the top to 40 inches at the station, the respective thicknesses of plates being 5-16 and 13-16 inch, while the distributor portion within the building is 1 inch. The total length of penstock is about 2,000 feet; it is carried on concrete piers with heavy anchorages and there are four expansion joints.

The two spill pipes are about 2,400 feet long, about 3 feet diameter, 7-16 inch plate, and with rivets countersunk on inside. These have several expansion joints and automatic air entry valves. They discharge water into the river below the power house.

In a plain concrete building are now installed five 1,000 h.p. units and two exciters, operating under a

Roman Plant at Tivoli: Penstocks under 165 ft. head.

head of 770 feet. These units are contained in a room 160 feet long and 40 feet wide, while in a central wing are located the busses, switches, switchboards and arresters.

The waterwheels are by Escher, Wyss & Company, having single nozzles with one runner. A feature of this wheel is its automatic hydraulic regulator. In plants of this pressure, European builders are using filtered water from the penstock instead of oil as a medium. This involves a mechanical filter on the governor to insure clean water. Escher, Wyss have what they call a "revolving filter," F, which can be worked by hand. The cycle of operation from the fly balls to the relay valve, with its fine adjustment to prevent "racing," through the lever system to the regulating valve S, thence to the main cylinder and piston P, and to the throttling lip L, can be readily followed. The generators are built by the Oerlikon shops and are 3-phase, 50 cycles, 13,500 volts at 375 r.p.m.; they are connected to the wheels with Zodel couplings. The switching is specially interesting, owing to the wide system of distribution, but it is simplified by having no transformers. Instrument pedestals of American type are installed, and the chief operator from his gallery can easily control all operations of the station. A unique arrangement of hydraulic jet lightning arrester is installed on a floor above the gallery. This combines a horn type arrester with a water resistance together with a choke coil and metallic ground wire.

For the distribution of this power and that from the lower station there is planned a network of over 250 miles of line, the farthest point served being about 50 miles distant. A characteristic is the widely scattered network of power service. The total population in the localities is about 100,000, the number of localities or communes designed to be served is 212, with 235 transformer stations. This is a striking example of the extensive detail of distribution which European companies are now carrying out, and both the people and the power companies of Ontario can at the present time benefit materially by following Swiss lead in this respect.

The power in these places is used for lighting, street railways, cement and brickyards, all manner of agricultural needs, such as churning, etc., watchmaking, weaving and miscellaneous shops and industries.

Small transforming stations, of standard design, about 10 feet by 12 feet inside and 27 feet high with 3 floors, are erected in many localities. These are built of brick or concrete and are cheap and neat in appearance. Some in city streets and parks are most artistic.

Prices are as follows: For light, 16 c.p. lamps, from 400 to 800 hours per year, \$3.60; over 800 hours, \$4.40. For heating, 8 cents per kilowatt hour. For motors, flat rate, on 11 hour basis, less than 1 h.p., \$60 per year; 1 to 2 h.p., \$40; 9 to 11 h.p., \$37; 25 h.p., \$33; 50 h.p., \$30; 100 h.p., \$29. On 24 hour basis add 25 per cent. to above figures. For motors on meter rates, from 2.5 cents per kw. at 1 h.p., down to 1.4 cents at 100 h.p.

Tenders were recently taken for the installation of telephones for the Hamiota, Man., municipal system. Joseph Andrews is Secretary-Treasurer, Hamiota, Man.

Articles of incorporation have been filed for the Minto Rural Telephone Company, with a capital stock of \$10,000. The principal office will be located in Harriston, Ont.

Peterborough Integrating Wattmeter.

The Peterborough Integrating Wattmeter for alternating current is now being placed on the market by John Forman, 248-250 Craig Street West, Montreal. This type "D" meter, Mr. Forman claims, is designed to meet the most rigid requirements of modern Central Station practice. Its construction is simple, substantial and practical. It is the result of years of experience in the manufacture, and also the operation of integrating wattmeters. This company make a specialty of electric meters and furnishing central stations with good appliances for measuring electrical energy. The Central Station manager has realized the usefulness of the meter system as a businesslike and profitable method of selling electric energy, and a demand has grown for a sturdy, accurate and reliable meter. The type "D" meter is designed to meet this demand. This meter is symmetrical in form and pleasing in appearance. It is furnished with a metal cover having a heavy plate glass front. It has been found that the entire glass cover is not substantial and has been eliminated. The case is insect and dust-proof and strongly constructed.

Peterborough Integrating Wattmeter.

The company state that the meter is equipped with the best sapphire jewels and the bottom of the main shaft carrying the disc is concaved with a highly polished hardened stell ball inserted; that it possesses a very high torque, insuring accuracy on low loads, and that the speed of the meter can be easily regulated by means of micrometer or screw adjustment provided. They state also that it records under a load of less than one per cent. of its rated capacity and registers within two per cent. of rated capacity to 50 per cent. overload continuously without injury. The dial reads in kilowatt hours without a consonant. Mr. Forman is general saleman and controls the output of the Peterboro' Integrating Meter, having introduced it throughout the whole of Canada.

Exhibits at the Canadian National Exhibition

Modern Machinery and Devices for the Generation and Application of Electric Power. Varied Display of Supplies.

The electrical exhibits at the Canadian National Exhibition this year were somewhat scattered, being placed partly in the Machinery Building, partly in the Process Building and partly in the Manufacturers' Annex. For this reason they did not make much of a showing although they were fairly representative of several large Canadian businesses.

The Canadian Westinghouse Co.'s exhibit was well placed near the centre of the Process Building, where they had more room to exhibit their appliances than most of the other exhibitors. They showed an interesting line of Nernst lamps, electric fans, and irons, motors, generators, switch boards, transformers and meters. Their exhibit was quite a centre of interest to visitors in this building.

The Colville Electric Co., of Toronto, exhibited a line of motors, generators and art fixtures which made quite an attractive showing.

The Canadian Independent Telephone Co., of 26 Duncan Street, Toronto, showed a complete line of switch boards, telephones, and all telephone parts, construction material, protectors, etc. This company reported that its business is advancing rapidly and that it is receiving orders from all parts of Canada, as well as from foreign countries such as France and Italy. It has also received an interesting communication from St. Petersburgh, which it has good reason to expect will lead to an order.

Harpell-Stokes, Limited, 155 King Street West, Toronto, Winnipeg, Edmonton and Vancouver, showed among other things a number of Century single phase motors. They also exhibited the well known Colonial porcelain sign letters made by the Colonial Sign & Insulator Co., Akron, Ohio, for which they are agents. An interesting part of their exhibit was the Excel ironclad irons made by the Excel Electric Heating Co., of New York. This company handle also the "Ideal Standard" dynamos and motors made by the Ideal Electric & Mfg. Co., of Mansfield, Ohio. Another of their specialties is the United States flaming arc lamp of 3,000 candle power for A. C. and D. C. This lamp is of the open flaming type giving an intense light of sun color or pure white. Their miniature arc gives a pure white steady light of 1,000 candle power.

Joyner & Greene, Toronto, exhibited their well-known specialty, the Dim-a-Lite, a portable attachment for dimming a single incandescent lamp. It gives four changes, "full," "dim," "very low," and "out," and is good for any lamp from 20 to 60 watts. They also showed a line of Helios arc lamps, Solderene, A. & J. M. Anderson's Railway Line material and the D. & W. Fuse Company's products.

In the same booth with Joyner & Greene was exhibited the Brand Electrophone Company's electrophone pocket telephone which magnifies sound for those who are hard of hearing. This is an attractive little instrument which has already proved itself of great service. The company's office is at 334 Spadina Avenue, Toronto.

The Stromberg-Carlson Telephone Mfg. Company's products, for which George Beattie, 109 Victoria Street, Toronto, is the Canadian representative, were shown in the Agricultural Implement Building. They included a complete line of "Call Apparatus" for magneto telephone service including telephones, switchboards and miscellaneous parts; also a variety of central energy equipments.

The Fleming Aerial Ladder Co., Limited, 52 Yonge Street Arcade, Toronto, showed the Queen City Motor & Dynamo Company's specialty, the Kay motor. The Fleming Co. have bought out the Queen Co. and intend to push the sale of the Kay motor vigorously. The Kay products include multi-polar bipole, alternating current, and induction motors, as well as dynamos for various purposes and electric organ blowers.

The Toronto & Hamilton Electric Company, of 99 McNab Street North, Hamilton, had an extensive exhibit of direct current dynamos and motors and induction motors, as well as a number of electrical devices. The company make a specialty of their induction motor which they claim has a very high power factor and is of the highest possible efficiency.

Langdon-Davies Motors (Canada), Limited, 15 Alice Street, Toronto, and London, Eng., had an exhibit of electric motors of the latest type including A. C. & D. C. The company also handle generators, switchboards, controllers, commutator grinders and other electrical instruments. One of their specialties is the Sigarera, a high-speed continuous cigarette making machine.

J. F. B. Vandeleur had an extensive exhibit in the Machinery Building of the products of the various English companies which he represents, including Evershed & Vignoles Bridge Meggers, combined portable volt and ammeters, portable volt meters and ammeters for A. C. and D. C., recording volt meters and ammeters, both American and English types; Berry Skinner & Company's patent foolproof switch gear and motor starting panels, and Connolly Bros. insulated wires and cables; the Gilbert Arc Lamp Company's flame lamps and carbons; the Morgan Crucible Morganite brushes and Battersea carbon brushes; T. H. & J. Daniels' gas engines, pumps, suction gas plants, and pressure gas plants; Reavell & Company's air compressors, vacuum pumps, etc., and Laurence Scott & Company's standard motors. The Gilbert flaming arc lamps shown by Mr. Vandeleur were extremely attractive. They are used for lighting the Thames embankment, London, Eng., where they add greatly to the artistic appearance of the whole locality. They are also used for street lighting in Manchester where they have given great satisfaction.

Jones & Moore Electric Co., Limited, 60 King Street, West, Toronto, exhibited a 60 k.w. generator, some A.C. motors, Century single phase motors, D.C. dynamos and an attractive electric cooking outfit.

The Standard Engineering Co., 43 Scott Street, Toronto, attracted much attention by their Standard Automatic Feed Regulators, which they fittingly describe as "The watch-dog of the boiler room." The company also make the Standard Pump Governor.

The Waterous Engine Works Co., Brantford, Ont., had an excellent exhibit in the centre of Machinery Hall, including a McEwen high-speed automatic engine of 56 horsepower. It supplied energy for a number of motors in the Process Building. They also showed one of the company's patent steam fire engines, which was sold to the city of Vancouver.

The Canadian Electrical and Motor Company, Limited, 468 King Street West, Toronto, showed a 60-horse-power producer, gas, power plant in operation,

This plant was manufactured by the Weber Gas Engine Company, Kansas City. It was direct connected to an electric generator, which showed conclusively the excellent construction of the plant and its good wearing qualities. The company report having sold several large plants in Canada. They also state that they intend soon to erect a Canadian factory for the manufacture of their goods.

The James Morrison Brass Manufacturing Company, 89 Adelaide Street West, Toronto, showed, among other things, a splendid assortment of gas and electric fixtures, and electrical engineers' and contractors' supplies.

McDonald & Willson, Toronto, Montreal and Winnipeg had a most attractive exhibit of electric light fixtures in the Process Building.

Keith & Fitzsimons, 111 King Street West, Toronto, attracted general attention by their beautiful display of electric fixtures.

Electrical Specialties, Limited, 12 Shuter Street, Toronto, had an attractive exhibit in the Automobile Building, where they displayed, among other things, their popular X cells. Their products also were to be seen in several of the other electrical exhibits.

The Northern Electric and Manufacturing Company, Montreal, showed a number of interesting articles. Among the features shown were the number 1317 and 1301 telephones which have been designed for use on party lines, especially those equipped with push buttons, wired so that by depressing same when signaling, the central office may be rung without ringing the other bells on the line. When this button is in its normal position the other parties can be called without ringing central. The exhibit also included Central Energy and Magneto Switchboards, Police Signal Service Telephone as adopted by the Police Department of the City of Toronto, Street Railway Telephone as adopted by the Toronto Railway Co., Railway Composite Telephone and Telegraph System, enabling telephone and telegraph messages to be transmitted simultaneously over grounded telegraph lines, and fire alarm apparatus as adopted by various cities and towns in Canada.

The telephone contract for the building of telephone lines in the municipality of Morton, Man., has been let to Elliott & Welch.

Local telephone companies are to be formed at the following additional places in Saskatchewan: Balgonie, Hanley, Swift Current, Maple Creek, Melford, Saltcoats, Wamsley, Sedley, Rouleau, Estevan, Briercrest, Weyburn, New Osgoode, Elmore, Esterhazy, Condie, Wadena, Wilcox, Aberdeen and McTaggart.

One of the most prominent exhibits at the annual meeting of the Michigan Electrical Association held in Grand Rapids, August 18 to 21, was that of the Nernst Lamp Company, of Pittsburg. The exhibit included a full line of the new Westinghouse-Nernst units, multiple and single glower, for alternating and direct current. The many new features of these lamps especially the screw burners and the wafer beaters, made the exhibit one of unusual interest to the lighting man present. The exhibit was beautifully illuminated by Westinghouse-Nernst 110 watt units. The company was represented at the convention by Mr. H. A. Browne, manager of the Detroit office and Mr. J. O. Little, manager of the publicity department.

Winnipeg's Electricity is Strong.

Winnipeg ratepayers who use electric lighting have recently been told that they are paying more for their light than is necessary, and the city electrician was instructed to report to the electric inspection office at Ottawa the facts in reference to the alleged surplus of voltage supplied to electric lamps for lighting purposes. A table of figures showing the oversupply of voltage was laid before the board by the city electrician and it was claimed that this oversupply resulted in the householder paying for more electricity than he used, and also in shortening the life of the lamp.

A copy of one of the recorded charts is reproduced herewith showing the result where the recording voltmeter was placed in a drug store on the corner of Notre Dame and Charlotte Streets, and the light turned on from 5.25 p.m. to 2.45 on the following day. The record shows that the 110 volt light was forced up from 125 to 130 volts. The erratic movements of the "recorder" from 8.30 p.m. until 11 p.m. are accounted for by the fact that the theatre and opera house lights

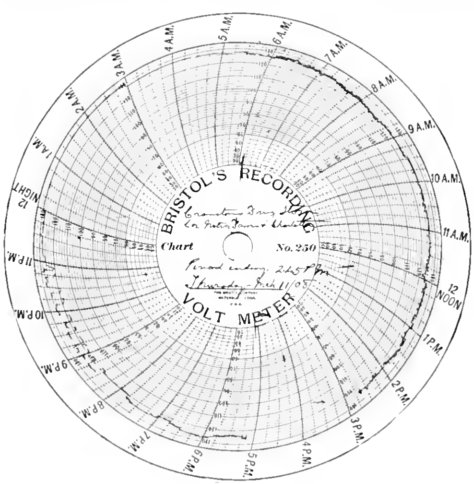


Chart Illustrating Winnipeg's Strong Lighting Current.

in the vicinity were shut "off and on" to the detriment of the 110 volt light in the adjacent drug store. These jumps were from 118 to 128 volts and very frequent, as will be noticed in the accompanying chart.

The city electircian sent the following report to the Council, who referred the matter to Ottawa:

Gentlemen, —As per your instructions I have taken readings of the voltage delivered by the Winnipeg Electric Railway Co. to their customers for electric lighting purposes at a number of points and present the charts herewith for your information. The instrument used was a recording voltmeter made by the Bristol Co. and is, I believe, accurate. The maximum and minimum voltages shown are as follows:

Chart No.	Location.	Maximum.	Minimum.
1	Langside St.	129 volts.	112 volts.
2	Langside St.	127 volts.	111 volts.
3	Young St.	127 volts.	117 volts.
4	Rupert St.	128 volts.	122 volts.
5	Rupert St.	127 volts.	123 volts.
6	King St.	127 volts.	120 volts.
7	King St.	130 volts.	122 volts.
8	King St.	140 volts.	122 volts.

TORONTO'S PIONEER ELECTRIC RAILWAY

How the First Practical Electric Road in America Was Operated in Toronto.

Westward from the southern end of the Strachan avenue bridge, Toronto, to the grounds of the Canadian National Exhibition, there is a stretch of abandoned railway track which in its way is one of the most interesting pieces of roadbed in Canada, writes A. J. Clark in the Toronto Globe. The purpose for which this track was built and the use to which it was put for several years, over two decades ago, may of course retain a place in the memories of quite a number of those whose interest at the time was not of the fleeting order. It is quite safe, however, to say that there are thousands who are not aware of its existence. Even those who are, may, with equal safety, be counted as being in ignorance of the facts that the rows of grass overgrown ties, the rails rusting under alternate sun and rain, and the toppling high board fence, separating them from

Toronto's First Electric Railway.

the parallel tracks of the Grand Trunk Railway, are monuments to the first electric road in Canada.

From careful investigation it would appear, also, that it is a claim well within the truth to aver that these remains represent about all that is left of the first electric road brought to a practical commercial basis on the American continent.

Dating, as it does, in a measure, from 1884, it antedates by about three years what is claimed to be the first successful venture of its kind in the Unites States, namely, the street railway system put in operation by Mr. Frank J. Sprague at Richmond, Virginia. At the same time experiments were being carried on by Prof. Elihu Thomson and the engineers of the Thomson-Houston Company at their works in Lynn, Mass., but while America was still trying Canada accomplished.

Mr. J. J. Wight, General Manager of the Toronto Electric Light Company, to whose efforts and inventiveness, in great measure, was due the success which attended the pioneer electric road, kindly consented to supply the authoritative facts upon which the present article is based and also loaned the very interesting photograph of the Exhibition "trolley" train which accompanies it.

In the fall of 1883 Mr. C. J. Vandepoele, a manufacturer of furniture in Chicago, being much interested in electrical matters as then developed, and following out experiments then being made in Europe, constructed an experimental model of a car and used an electric dynamo as a motor. This was shown at the Interstate Exposition held in Chicago in that year. The following year, 1884, Mr. Vandepoele made arrangements with the Exhibition Association of Toronto to demonstrate the possibility of running a car by electricity at the Exhibition grounds. He conveyed the current from the generating dynamo to the car by means of strips of copper led in a box laid along the ties between the rails. This was not very successful, and to avoid an entire failure, Mr. Vandepoele ran an overhead wire with a sort of jack-in-the-box arrangement which by means of a spring pushed a wheel up against the wire. This was the forerunner of the present trolley.

The necessity for a connecting link between the city street railway's horse-car terminus, on the north side of the railway crossing, on Strachan avenue, and the Fair grounds was at this time keenly felt, so the following year Mr. Wright took charge for the Toronto Electric Light Company, and what was known as the "Industrial Exhibition Electric Railway" became a reality. So much of a reality was it, in fact, that for several years or until the electrification of the Toronto Railway's lines the little system annually hauled between sixty and seventy thousand passengers during the ten days' continuance of the Exhibition. It was remarkable, too, that notwithstanding the high voltage current employed (about 2,000) all this was accomplished without injury of any kind to patrons or operators.

The undertaking at the outset was one requiring both courage and ingenuity, for each forward step had practically to be made in the dark. There were no precedents to follow; no patterns conveniently numbered and stored away upon which to fall back when some unexpected contingency arose. Everything had to be made for the occasion in the most pronounced sense of the word.

First came the building of the machines for generating the necessary power. These were installed in the general Machinery Hall at the Exhibition grounds, and were built to give 50,000 horse power. Next came the equipmenut of the train, for the single car idea had not yet presented itself. Indeed, even if it had and the public had been invited to take seats on the same car with the man engaged in manipulating the illusive, mysterious and deadly current, it is extremely doubtful if the above figures as to patronage would be on record.

But to get back to the equipment of the line. The motor for the "locomotive car" was the next consideration, and it had to be built specially for the purpose. What this "locomotive" looked like may best be gathered from the reproduced photograph. The motor was connected with the driving wheels of the car, and its speed reduced to that of the drivers by a system of counter-shafts and leather belts.

The current was conveyed along the Exhibition line by means of an overhead wire and the return effected through grounded rails, the latter being of regulation railway type. The "trolley pole," if such it might be called, was quite unlike the simple arrangement of the present, but it enjoyed one distinct advantage: it was equally ready for business whether the car was run forward or backward. In this it was well suited to the use to which it was put, as the little road was a straightaway affair, each return trip being made by backing up to the starting point.

The motor car or "locomotive" drew behind it three trailers, single truck flat cars, equipped with cross seats, each having four double seats back to back.

One of the greatest difficulties experienced in the early operation of the line was the getting of men who cared to undertake the handling of the motor, accompanied, as its stopping and starting often was, by sundry blinding flashes, serpentlike hisses and ominous internal mutterings, and for much of the time Mr. Wright was forced to be his own motorman. In this way he was often at the trying post from 8 o'clock in the morning until 11 o'clock at night.

On one occasion, in backing up the train, the rear car left the rails, owing to the defective handling of the brakes, crashed through the fence and pulled after it, into the adjoining railway cut, the entire rolling stock of the road. For a short time things looked dark for the future of electric railroading, but every available man about the Exhibition was pressed into service and the whole outfit was carried bodily up the bank and replaced on the rails. It was then feared that the accident would have a depressing effect on patronage, but even the first trip after things were set to rights showed no falling off in that respect, and the incident was soon forgotten.

Even at the close of his several years' successful conduct of his experimental line, Mr. Wright was far from sanguine as to the real value of electricty as a motive power; and now tells with a smile that the difficulties to be overcome seemed so great that it was his opinion that the system could never be used in the crowded streets of a city. Just how far that estimate was wide of the mark we all know now, but even this opinion was not further astray than that of the scientist who demonstrated the mathematical impossibility of a steamboat being able to carry coal enough to push itself across the Atlantic. Among the most interested spectators during the first year or two of the running of the Exhibition road were the locomotive engineers of the Grand Trunk Railway. They would look through the fence with great curiosity and the remarks they would make on the new arrival were quite characteristic. They would say, "That thing would never pull a train of freight cars." "That thing" certainly would not, but it contained the germ of the present day electric locomotive that not only will pull a freight train, but two or three of them, as at that time constituted, and at a speed of sixty miles an hour at that.

In marked contrast with his somewhat pessimistic outlook of twenty years ago, Mr. Wright to-day considers that it is not an idle dream to look forward to the time when all lines of transportation in Ontario, even trunk lines, will be operated by electricity generated by the Province's great water falls.

The second electric road in Canada, and one which has often been credited with having been the first, was a line between Thorold and St. Catharines. A peculiarity of this road, which makes it worthy of mention in the present connection, was that instead of a single trolley and the grounded rail return, there were two wires overhead, a positive and a negative. A four-wheeled carriage ran upon the top of these wires, two wheels on each, and was towed by a flexible cable from the car. A result of this arrangement was that when the 'trolley was off" instead of a pole flying up into the air the whole apparatus came thundering down upon the roof of the car, to the manifest discomposure of nervous passengers.

In 1887 the Exhibition Association, as an expression of esteem, presented Mr. Wright with a handsome silver tea service and an illuminated address setting forth their appreciation of his success in providing a means of transportation which had been of great assistance in handling the yearly crowds.

The address, which is signed by the late John Withrow, as president, and the late Donald C. Ridout as chairman of the Macihnery Committee, is treasured by its recipient as a memento of an experience which he now looks upon as having blazed, to no inconsiderable degree, the way for the wonderful development of to-day in the electrification of both urban and suburban railway systems.

Recent Publications.

The McGraw Publishing Company, New York, have issued a handy little book upon hydro electric development, written by Preston Player. At a time when hydro-electric developments are attracting wide-spread interest from investors, capitalists and bankers this book will be very welcome. Its subject matter is more in the nature of a discussion than a treatise, and its object is to indicate the information which should be obtained in order to afford a definite basis for a decision as to the merits of any proposed undertaking. The book combines the merits both of brevity and thoroughness, and should be found extremely useful.

The Standard handbook for electrical engineers, second edition corrected, has been issued by the McGraw Publishing Company. No new material has been added to this edition, with the exception of directions for resuscitation from electric shock. Care has been taken to render the data contained in the book as accurate as possible. This excellent handbook has obtained wide popularity and has already been adopted in thirty universities and colleges as a text book. It is attractively published, bound in leather and well indexed.

Questions and Answers in Electrical Engineering, by A. E. Moore, A.M.I.E.E., and Frank Shaw, published by Longmans, Green & Company, London, is a small book with a great deal of information in it. It has been compiled primarily for the assistance of students intending to become candidates for the elementary examination in electrical engineering, held by the city and guilds of London Institute. The book is a compilation of the questions set by the Institute in the preliminary grade on electric lighting from 1898 to 1907 with solutions to all questions.

Andel's Gas EngineManual, a practical treatise with illustrations and diagrams, published by Theo. Andel & Company, New York, deals extensively with the theory and management of gas, gasoline and oil engines, and includes chapters on producer gas plants, marine motors and automobile engines. The book is primarily intended for the use of gas engineers and machinists operating machines driven by gas engines. Its scope

for this reason is necessarily limited, but the information contained gives evidence of being based upon long experience and the most recent practice. There are a number of useful chapters giving detailed description of some of the standard types of modern gas, gasoline and oil engines, which will help engineers to familiarize themselves with the principal forms of engines, and will be of assistance to any intending purchaser in the selection of an engine.

Electrical Contracting, by Lewis J. Auerbacher, published by the McGraw Publishing Company, deals in a useful manner with such matters as shop system, estimating, wiring, construction methods, and business getting. It is written for the wireman and contractor, and gives him a lot of practical hints on the latest construction methods and various means of increasing his income. A system of accounting is described which will be serviceable to electrical contractors by helping them to detect financial leaks and to systemize their accounts. The devices and wiring methods described are those only which have been approved by the Underwriters. The book contains a number of illustrations.

The McGraw Publishing Company have issued a treatise upon telephone law and the organization and operation of telephone companies, written by A. H. McMillan, late editor of the American Telephone Journal, and a member of the Bay City, Michigan, bar. The book is largely the result of the author's studies as a legal editor, and is intended not for practising lawyers so much as for those actually engaged in the telephone business. It is therefore not exhaustive, but gives in a compact and concise form much legal information which will be of value to the practical telephone man.

Francis B. Crocker, E.M., Ph.D., has published a treatise upon dynamo-electric machinery, which is copiously illustrated, and issued by the American School of Correspondence, Chicago. The book contains an authoritative treatise on theory, construction details, calculation, characteristic curves, and design of dynamo-electric machinery. The method adopted in the preparation of the book is that which the American School of Correspondence has developed and employed for many years, making it a useful source of education for the busy working man.

Von Schon's Hydro-Electric Practice published by J. B. Lippincott Company, Philadelphia and London, is an exhaustive treatment upon its subject. The author, Mr. H. A. E. C. von Schon, is a civil and hydraulic engineer, and a member of the American Society of Civil Engineers. The book is a practical manual of the development of water power, its conversion to electric energy, and its distant transmismission. It is extensively illustrated and is published in an attractive style. The purpose of the volume is to place within the reach of the promoter, investor and practitioner, an analytical treatment of hydro-electric practice in all its phases from conception to realization. The subject is really in two parts, the first being an analysis of a hydro-electric project, written for the layman. The second part with designing and equipping the plant and is written for the student and practitioner. The book covers the subject in a thorough manner and will prove a valuable addition to any electrical engineer's library.

The Westinghouse Company have issued an instructive pamphlet, number 5034, upon the "Type L Triple Valve" of the Westinghouse Air Brake Co. The pamphlet sets forth in an attractive manner the utility of the triple valve and its many good points, chief among which are its quick recharge, quick service, graduated release, and high emergency cylinder pressure. The pamphlet is well illustrated. An instruction pamphlet on the A. M. S. Brake Equipment has also been issued by the Westinghouse Traction Brake Co. The pamphlet includes a quantity of useful information and rules for operating the A. M. S. Brake Equipment, and single, motor and trailer cars.

The Hill Electric Switch Co., Limited, 1560 St. Lawrence Boulevard, Montreal, have issued a bulletin descriptive of a few of their products. The bulletin deals particularly with their type "D" switches. It also includes a price list of their style "D" products, which shows them to be well worth enquiring into. Their style "D" is listed in various forms, including single pole, single throw; single pole, double throw; double pole, single throw; double pole, double throw; three-pole, single throw, and three-pole, double throw. Their type "E" time switch is also included in an insert. This is a simple, inexpensive device for turning off light at a pre-determined time. It allows the user to close his place of business and leave his show windows and signs in a blaze of light without the necessity of any one returning to put the lights out at a later hour.

An attractive booklet upon boilers and accessories, issued by the Jenckes Machine Company, Sherbrooke, Que., has reached us. The booklet describes the various products of the company and tells in a convincing manner of their excellent qualities.

The Jenckes Company's facilities have recently been

augmented by the erection of extensive branch works at St. Catharines, Ont. The product of the two shops includes horizontal return tubular, vertical tubular and locomotive type boilers for medium or high pressures, as well as steel penstocks, steel smokestacks, smoke connections, tanks, refuse burners, water towers, stand pipes, and all manner of steel plate work. The shops are equipped with the most improved machinery and are in a better position than ever to handle a large volume of business expeditiously. They contract for complete steam power plants, including engines. Any one in need of such products will do well to obtain a copy of this booklet.

"The Motorman and His Duties," a handbook of the theory and practice of electric railway car operation, was written some time ago by Ludwig Gutmann, consulting electrical engineer. Five editions have been printed and sold. The sixth edition comprises a revision and enlargement by Lawrence E. Gould, editor of the Electrical Railway Review. The book explains in a simple way the fundamental principles underlying the operation of an electric railway car and outlines clearly the relation existing between the track, power station, distribution circuits and the car itself. Its language is devoid of mathematics and technicalities. The fundamental principles of the electric motor are introduced in the second chapter. The third chapter considers the generating and distribution of power, outlining the essential parts of a power station and defining the method now most generally used for distributing current.

Other chapters deal with the working conductor and the use of transmissio lines; the constructional details of electric railway motors of standard types; car wiring and parts; and the principles, construction and methods of operation, of controllers of various standard types. The latest types of multiple-unit control and drum control using uxiliary contractors are also considered.

A useful chapter is one showing how troubles on the road may be prevented or remedied. A glossary describing the principal terms and individual parts mentioned is a valuable part of this book. The book is profusely illustrated.

Trade Enquiries.

The Dominion Government Trade and Commerce reports contain the following trade enquiries. Readers of "The Canadian Electrical News" may obtain the names of enquirers by writing us. State number of enquiry.

1176. **Cables.**—A London firm dealing in electrical cables (manufactured in France and Switzerland) wishes to get into touch with Canadian buyers.

1181. **Agents.**—A Scottish firm wishes to appoint Canadian agents for the sale of iron, steel, brass and copper wire, steel wire ropes, galvanized sheets, castings and similar goods.

1199. **Mica.**—A Manchester electrical company seeks supplies of amber mica and would be pleased to hear from Canadian producers and shippers.

1278. **Fittings.**—A Birmingham firm enquires for buyers of gas and electrical fittings.

1325. **Machinery.**—A firm in the Argentine Republic desires to secure the agency of some Canadian manufacturers of agricultural, industrial and electrical machinery.

R. R. Houghton, secretary-treasurer, rural municipality of Strathcona, Belmont, Man., has just taken tenders for the construction of telephone lines.

Death of Mr. T. Edward Lamb.

It is with much regret that we record the death of Mr. T. Edward Lamb of the firm of Laurie & Lamb, consulting and contracting engineers, Montreal. Mr. Lamb passed away at Caledonia Springs on the 13th ult. after a very brief illness. His death was quite unexpected, as, on leaving Montreal a couple of days before, he expressed his intention of returning to the office within a few days. Mr. Lamb was only forty-four years of age, and was an engineer of exceptional ability. He was well-known among mechanical engineers from one end of Canada to the other, having been for many years superintendent and chief engineer of the original Laurie Engine Company, Montreal. Many now holding important positions in mechanical engineering circles passed under his control as apprentices or engineers. The loss is a severe one to his partner, Major W. H. Laurie, with whom Mr. Lamb has worked continuously since leaving school at the age of seventeen, when he entered the service of John Laurie & Bro. (afterwards formed into the Laurie Engine Company),

The Late T. Edward Lamb, of Laurie and Lamb.

as apprentice draftsman, rising subsequently to the positions of chief draftsman, shop foreman, superintendent and chief engineer. The late Mr. Lamb had been in partnership with Major Laurie for the last three years. He was a prominent member of the Episcopal Church, being a church warden of St. Luke's Church, Montreal. Mr. Lamb was a Freemason, and also a member of the Canadian Society of Civil Engineers.

Trade Notes.

The Packard Electric Company, of St. Catharines, Ontario, are supplying a number of large transformers for the American Cynamid Company, Niagara Falls, Ont., and Electric Metals, Limited, Welland, Ont. These include one of 750 k.w., seven of 800 k.w., four of 165 k.w., and three of 85 k.w.

The Eugene F. Phillips Electrical Works announce the removal of their Toronto office from 50 Adelaide Street West to Rooms 804 to 805, Traders Bank Building, where their representative, Mr. J. P. Thomson, will be pleased to meet their customers and friends.

TELEPHONE TOPICS

Independent Telephone Convention.

The third annual convention of the Canadian Independent Telephone Association was held in the City Hall, Toronto, on Wednesday, Sept. 9th. A preparatory meeting of the executive committee was held on Tuesday evening, and the business meeting commenced on Wednesday at 10 a.m. From the interest which was taken in the meeting beforehand, it was certain that there would be a large attendance and that the discussions and business would be thorough and complete. Among the prominent men who were expected to be present and address the meeting were the following: Hon. Richard Turner, Hon. Jules Allard, Ton. Adele Turgeon, and Sir E. B. Garneau, of Quebec; Rodolphe Forget, M.P., Montreal; J. H. Shoemaker, President of the Iowa Independent Telephone Association, and J. B. Ware, Secretary of the International Independent Telephone Association.

An invitation was extended to the members of the Farmers' Institutes who were holding a meeting at the Canadian National Exhibition, on September 8th and 9th, to be present and listen to the proceedings on the afternoon of September 9th. A number of the farmers attended and found the subjects discussed were of much interest to them.

The meeting was opened by an address of welcome from the Mayor of Toronto and the Chairman of the Civic Reception Committee. A reply on behalf of the Association was made by Mr. T. R. Mayberry, M.L.A. This was followed by the President's address, the reports of the Secretary and Treasurer, and the appointments of committees. After this the Association settled down to the discussion of the various topics which had been arranged.

The topics for discussion and the members arranged to introduce them were as follows: Bell Connections, Dr. W. Doan; Independent Telephones at Railway Stations, C. Skinner; Organization of Rural Companies, (a) Mutual vs. Joint Stock Companies, A. R. Walsh; (b) Rural Line Equipment and the Best Way to Serve the Farmers, F. A. Dales; Telephone Rates, (a) Rates to be Charged, and the Best Form of Collecting, A. Hoover; (b) To What Extent Should Free Service be Given, A. D. Bruce; Division of Territory between Telephone Companies, Levi Moyer; Toll Line Connections: How Best Effected, Alex. Neilson and Henry Sneath; Western Situation and its Future, F. Dagger; Our Interests in Towns and Cities, M. Gee; The Independent Movement in Towns and Rural Communities, T. R. Mayberry, M.L.A.; Exclusive Franchises and Government Regulation, Dr. A. Ochs; Organization; Resolutions.

The report of the Secretary, Mr. F. Page Wilson, stated that there had been a remarkable development of interest in the Province of Ontario during the year. The indications were that only a little time was needed to place Ontario in line with the States of Ohio and Indiana in the matter of independent services. A year ago the estimated number of independent telephones in operation in Canada was 18,000. To-day it was about 25,000. The independent companies formed and in existence to-day according to the Secretary's list amounted to 338. On September 1 the Association had a membership of 65 paid up and enrolled as well as seven municipalities.

Ontario was a long way in the lead in the number of independent companies and also in the number of new companies formed within the last twelve months. So far as reports have come to hand all these companies showed satisfactory progress. The largest and most important independent telephone company in Canada was the National Telephone Company in the Province of Quebec. This company was now starting work upon the installation of an extensive system in the City of Quebec.

In the Maritime Provinces there had been no great movement in the independent field, but the indications were promising. In New Brunswick there had been a strong movement in favor of independent serivce.

The situation in the West was referred to briefly. Manitoba's purchase of the Bell system was said to have been on such high terms as to prevent the full benefits of competition from being obtained. Alberta had made a better bargain. In Saskatchewan a rapid development of cheap telephone facilities was expected. In British Columbia several flourishing companies had been established.

The report referred to the efforts which had been made by Mr. Phil. Boyer, M.L.A., to do away with the power of municipalities to grant exclusive franchises. Although not successful, the campaign had done a great deal of good so far as the independent movement was concerned in Ontario.

Bell Company's Ontario and Quebec Plans.

It is announced at Montreal that the Bell Telephone Company will spend $1,000,000 in improving the company's service in Ontario and Quebec.

The company is building through lines from Toronto to North Bay, a distance of 230 miles, to connect at the later point with the Ontario Government system to the new districts of Ontario. Another line from Toronto to Parry Sound will be constructed to embrace a number of summer resorts in the Muskoka lakes district. An additional telephone line direct between Montreal and Quebec has been completed.

In Montreal the Bell Telephone company is erecting a new exchange building in the north end to be known as the St. Louis exchange. The wires are being placed underground, which is proving expensive to the company as the surface is largely rock and the excavation is slow and tedious.

In Toronto the company will put up a commodious building five stories high, sufficient to accommodate 20,000 subscribers, and in addition to this all long distance work will be centred in this building.

At Quebec a large addition is being built to the present exchange which will be ready for occupation in about three months, and in which a new switch board apparatus will be installed.

The following officers have been elected by the Leeds & Grenville Independent Telephone Company of North Augusta, Ont.: President, Reeve J. H. Dawson; vice-president, A. P. Bissell. The managing director is Charles J. Johns.

Peculiar Cases of Trouble.

The following letter on trunk line trouble is published in a recent issue of the American Telephone Journal.

In a recent issue I noticed an article on a case of trouble caused by a hawk. Upon two occasions our repairer has had cases of trouble which were similar, except that they were caused by grouse, which he brought home with him and had for his dinner.

The West Kootenay Power & Light Co., which operates high-tension lines at 60,000 volts through the Kootenay country has upon three occasions had short-circuits, and consequent breaking of wires, owing to owls flying into the lines. The wings of the owls made contact with two sides of the circuit, forming an arc, and the resultant burns opened the circuit.

I also send you one of our trouble cards, showing a case where a man was knocked off the railway trestle by a passing train, and fell among a lead of wires, which saved him from injury, as the distance from the top of the trestle to the ground is about 50 feet.

G. C. HODGE.

BRITISH COLUMBIA TELEPHONE CO. LIMITED

TRUNK LINE TROUBLE REPORT

FORM

Greenwood Agency

July 2 1908.

Trouble on Wire No 3. 11 & 12 Trunk lines

Time observed 9 A.M

Day of Month 2nd

Time started out to Repair 9:15 AM

Day of Month 2nd

Time Repaired 10:45

Day of Month 2nd

Where trouble found Pole 912 near Phoenix

Cause of trouble Man knocked off trestle by passing train & fell amongst wires. Wires saved man from injury

No. of breaks 2. & 1 cross.

How journey made Horse & Rig
(foot, horse, bicycle, train or boat.)

Expenses in detail
Meal 50

A Legault ~~Agent~~ Repairer.

Peculiar Trouble Report.

A Regina report states that negotiations are progressing for the purchase by the province of the Bell Telephone Company's plant. The report says that the Bell Company is understood to be willing to accept about $750,000 for its holdings. If this is brought about it will mean the relinquishment by the Bell Company of its last territory between the Rocky Mountains and Ontario.

Central and Exchange Notes.

Considerable extensions are planned by the Molesworth, Ont., Telephone Company.

The Manitoba Telephone Commission is now constructing a line to Hannah, North Dakota.

The new Government telephone exchange in Winnipeg will be ready for occupancy about October 1st.

The Western Saskatchewan Telephone Company are making arrangements to build a line between Drinkwater and Belle Plain.

The construction of the telephone system at Dunedin, Ont., is to be undertaken at once by the recently incorporated Noisy River Telephone Company.

At a recent meeting of the directors of the Temiskaming Telephone Company, Haileybury, Ont., it was decided to construct a line to Silver Centre.

Manager Dunstan, of the Bell Telephone Company, states that tenders will shortly be called for the company's new building on Adelaide Street, Toronto.

The lines of the Hamilton Township Rural Telephone Company, which have recently established connections with Cobourg, are to be extended in Northumberland County.

The Manitoba Government has secured a number of subscribers for the proposed telephone line in the district west of Carman and arrangements are now being made for its construction.

Tenders have just been taken by J. H. Agnew, Provincial Treasurer, Winnipeg, Man., for $400,000 four per cent. 40-year debentures, in denominations of $5,000 each, issued for the purpose of telephone construction.

The range of the Independent Telephones in the district of Markham, Ont., will shortly be still further extended by connection with the Uxbridge and Scott Company's line, and the extension of the Bethesda and Stouffville Company's line to Richmond Hill.

The New Dundee Rural Telephone Company, Limited, New Dundee, Ont., has been incorporated with a capital of $10,000. Incorporators, J. C. Hallman, A. McDonald, W. Erb and David Bergey, all of the township of Wilmot, and Amos Hilborn, of New Dundee.

The farmers' telephone line at Airdrie, Alta., has been completed and is now in operation. The system includes thirteen miles of pole line and 30 miles of wire with twenty-five subscribers. The installation cost approximately $40 per telephone and an annual levy will be made for maintenance.

Estimates and plans have been made by the Manitoba Telephone Commission showing that the work of constructing a telephone system in the Municipality of South Norfolk would cost $17.80 per telephone per year. About a year ago the municipality of South Norfolk decided to install a municipal telephone system and offered telephone service at $15 per year receiving 112 subscribers at that rate.

It is stated that at the next session of the Ontario Legislaure the Government will introduce a new measure in which provision will be made for the control, stimulation and development of county and independent telephone systems operating in Ontario under Provincial charters. Two propositions are believed to be under consideration, one appointing a Provincial Commissioner of Telephones, an expert with advisory, consultative power; the other to enlarge the membership of the Ontario Railway and Municipal Board by the addition of a representative expert on telephone problems.

QUESTIONS AND ANSWERS

GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS:

1. All enquiries will be answered in the order received, unless special circumstances warrant other action.
2. Questions to be answered in any specified issue should be in our hands by the close of the month preceding publication.
3. Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment should be placed in the hands of a consulting engineer, caot be considered in this department.
4. To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possible doubt as to the information required.
5. In all cases the names of our correspondents will be treated confidentially.

Question No. 1.—Is the Tungsten lamp really more efficient than the arc lamp, and, if so, will it not displace the latter owing to its higher efficiency?

Answer.—The mean hemispherical efficiency of an enclosed arc lamp is about 2.6 watts per candle, while the Tungsten average about 1.6 watts per candle, or, in other words, is approximately 40 per cent. more efficient. In spite of this, however, it is probable that the arc lamp will still find quite a large field for interior lighting, due to the fact that the total cost of a given amount of light from it will very often be found less than in the case of the Tungsten, the high cost of renewing the latter making the total cost of light run up higher than you would otherwise think. As far as cost alone is concerned, the choice between the two depends very largely on the cost of energy. The dividing point is somewhere round seven to nine cents, at prices materially lower the arc showing up the better of the two, while if your current costs you materially more the Tungsten will probably be cheaper. As far as convenience and appearance are concerned, the Tungsten is probably the better, though it has to yield the palm to the arc when a white light is desired. Here the arc is undoubtedly superior, its light being the best approach to daylight that has yet been commercially produced. As such it is the proper illuminant for stores selling dry goods that are to be used in daylight, for jewellery, etc., though for places like furniture stores, lunch rooms, etc., the color of the Tungsten is very suitable.

Question No. 2.—What is a 2000 c.p. arc lamp, or is there any such lamp in ordinary use?

Answer.—The old 9½ ampere open arc lamp, taking about 40 to 45 volts, was at first known as a 2000 c.p. lamp, the term being generally accepted to cover that lamp notwithstanding that it never gave, nor could it be made to give, anything like 2000 candle power, except as the result of some abnormal condition. When the question came to be looked into more closely, it was soon seen that the rating was entirely conventional, in view of which the understanding gradually came to be that such a lamp, if the term still happened to be used, was one consuming 450 watts. This is now generally accepted practice, though in view of the fact that both the term and the open arc lamp are now almost obsolete, the point does not very often come up.

The ordinary enclosed direct current carbon arc of 450 watts gives somewhere around 300 to 400 average spherical candle power, the readings at the maximum point being perhaps 50 per cent. greater. The open arc is somewhat more efficient, but only say 25 per cent., so it will be easily seen that it was far from being of 2000 c.p. It should be noted that in view of the introduction of higher efficiency lamps, such as the magnetite, the present practice of rating in watts will have to be modified, probably by the substitution of a luminometer reading or its equivalent.

Question No. 3.—Can you tell me the derivation of the size of 16 c.p. that is used in rating incandescent lamps. Is it a legal unit?

Answer.—The term comes directly from the standard for gas, 16 c.p. being the candle power required by the Act from an ordinary bare flame consuming five cubic feet per hour. As this was what electric light had to compete with when it came on to the market, it was a very natural thing to make the standard lamp of that size. The term has a legal standing in gas practice, being, as advised above, the light required from a five foot burner, but there is no corresponding clause in the Electric Light Act, the only specifications on the point being that all lamps used in Canada shall have the voltage and candle power marked on them.

Question No. 4.—What is the objection to leaving a current transformer with the secondary open? I see notices on some series transformers stating that a short-circuiting wire must be put on them if the instrument is disconnected.

Answer.—The reason for requiring the secondary to be always closed is that if left open-circuited, with a current flowing in the primary, the transformer may be burnt out, besides which someone might get quite a severe shock from the secondary terminals. The reason for the transformer burning out when run with an open secondary is that the magnetization of the iron core runs up to a very high point under such conditions, this high density in turn resulting in very high core losses, these large losses usually producing a temperature high enough to burn up the insulation, because series transformers as a rule have not enough radiating surface to get rid of any heat other than that generated by the small losses that occur when the apparatus is run under normal conditions.

The reason for the high magnetizing density that occurs with the secondary open is that in any transformer the magnetization in the iron is the difference between that generated by the primary current and that produced by the current flowing in the secondary, the two always opposing each other. Obviously, if the secondary be open there can be no current flowing in it, which in turn means that there can be no secondary flux, therefore the primary flux is the only one to be considered. If you are dealing with a constant potential transformer this flux simply rises, when the load is taken off the secondary, until it chokes down the primary current to a very small amount. In a series transformer, on the other hand, this choking effect cannot take place, because the current in the primary must be whatever is flowing in the circuit in which the transformer is connected, therefore, on any appreciable load the primary flux goes away up, in the absence of any secondary flux to counteract it. We presume you understand not all current transformers will burn out under the condition you name, it depends on the particular design in question, also on the amount of load that the circuit is carrying, still it is always a wise precaution to keep your secondary closed.

Ontario Transmission Line Contract Let.

The Ontario Cabinet has approved of the contract between its Hydro-Electric Commision and the F. H. McGuigan Construction Company for the construction of transmission lines from Niagara Falls to St. Thomas, in the west, and Toronto, in the east, 293 miles in all, for the sum of $1,270,000. The tender is remarkable as being wholly Canadian, which, in the face of so many English and American tenders, is regarded as very creditable to native enterprise. Steel towers, numbering 3,176, will be supplied by the Canadian Bridge Company and the Ontario Iron and Steel Company. They will consume 6,554 tons of steel. The cables will be of aluminum, weighing 1,014,209 pounds. This will be supplied by the Northern Aluminum Company of America, at Shawinigan Falls. For the double telephone line, over the right-of-way, 140,000 pounds of wire will be required, and guard lines and lightning protection will also take a large quantity of metal. Separate tenders were sent in for several portions of the work, but Mr. McGuigan's tender was lower than the lowest combination of any of these. His tender was therefore accepted on its merits. The work is to be completed within 15 months from the signing of the contract, so that the line will be ready to deliver power in December of next year.

Messrs. Smith, Kerry & Chase, of Toronto, have been engaged by Mr. McGuigan to carry out the work. This firm rendered material assistance in the preparation of the tender for Mr. McGuigan. Mr. C. B. Smith has been intimately acquainted with the work of the Hydro-Electric Power Commission since its inception, having been chief engineer for the first Provincial Commission and for a period a member of the second, the present Commission. He is thus eminently fitted to advise Mr. McGuigan in his handling of this extensive contract.

Alberta and Manitoba are discussing their respective bargains with the Bell Telephone Company, says The Canadian Courier. It is declared that Manitoba paid the company $212.38 for each telephone, while Alberta paid only $143.00. Manitoba has not been able to reduce rates, while Alberta is in a better position in this respect. Alberta has not really reduced rates, as these were already somewhat lower than in other provinces. Saskatchewan has drafted a provincial policy and will construct trunk lines parallel to all the existing railways. As the Bell lines have not been purchased, this will mean duplication if a bargain is not struck. Construction will begin shortly. By legislation passed at the recent session, municipalities and rural communities may form local companies with certain privileges of connection with the trunk lines. Rural lines will be assisted by the government.

K. L. Aitken, C.E., Toronto, has been appointed by the City of Chatham to run the official tests on the municipal producer gas equipment.

The Missouri Telephone Company, Kintore, Ont., has been incorporated with a capital stock of $15,000 by D. McMillan, W. I. Hogg, W. H. McGee and others.

The Farmers' Long Distance Telephone Company, Mull, Ont., has been organized with a capital stock of $40,000. The company is a consolidation of two local companies, and is planning much new construction work. The officers of the company are as follows: Neill Watson, of Mull, president; James Rutherford, of Blenheim, vice-president, and L. Edmunds, of Blenheim secretary.

K. L. Aitken Appointed.

Mr. K. L. Aitken, Traders Bank Building, Toronto, has been appointed engineer to take charge of Toronto's electrical distribution plant. It is agreed that Mr. Aitken shall give up his private practice and receive a salary of $3,600.

Mr. Aitken located in the city four years ago. During this time he has constructed among others the following plants: Complete steam and electrical equipment for the town of Milton, Ont., covering incandescent and street lighting, 100 horsepower; engines and electrical equipment for the factory of the Copeland-Chatterson Co., Brampton, 120 horsepower; complete electrical plant for the town of St. Mary's, for incandescents, power, and street lamps, 250 horsepower; complete steam and electrical equipment for Barrie, for incandescents, power and street lighting, 500 horsepower.

Important positions have been held by Mr. Aitken with Westinghouse, Church, Kerr and Company, New

Mr. K. L. Aitken.

York; Sprague Electrical Company, Bloomfield, N.J.; Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., and the Canadian General Electric Company, Toronto.

The Provincial Government of Saskatchewan has announced its intention of building the following long distance telephone lines: From Lumsden to Prince Albert, connecting with the towns along the C.N.R.; to serve towns and villages along the Arcola and Estevan branches of the C.P.R.; branch lines east and west from Warman to the boundaries of the province and following the C.N.R.; branch lines paralleling the Wolseley-Reston, Pheasant Hills, Weighburn and Staughton railways; from Prince Albert, connecting Kinistino, Melfort, Star City, Tisdale and other towns and villages; crossing the province from north to south and connecting Alameda, Carlyle, Wapella, Yorktown and Saltcoats. Branch lines will also be laid out to follow the railway branches.

THE POWER SITUATION IN ONTARIO

Two Writs Issued to Prevent Toronto from Contracting with the Commission.

Since the Ontario Hydro Electric Commision has brought its affairs to such a stage of completion as to have awarded the contract for the building of its transmission line, those who are opposed to the Government's policy, particularly those who believe that it will involve the various municipalities in heavy unforeseen expenditures, have entered actively upon a vigorous campaign of opposition. The two most important stages in this movement have been the requests at Osgoode Hall for two injunctions to prevent the City of Toronto from entering into any contract with the Commission and to restrain it from taking any action upon the by-lawof May 4, 1908, whereby such a contract was agreed to by the City Council. One of these writs has been issued on behalf of Mr. Walter D. Beardmore by Messrs. O'Brien & Lundy, who are also solicitors for the Toronto Electric Light Co. The second writ was issued by Mr. Jas. Pearson, of Pearson & Denton. Both the Electrical Development Co. and the Toronto Electric Light Co. have disclaimed any connection with the writs. The writ issued on behalf of Mr. Beardmore is as follows:

"The plaintiff's claim is that he is a freeholder, resident, inhabitant and ratepayer of the City of Toronto, and sues on behalf of himself and all other freeholders and ratepayers for a declaration that the defendant municipality is not and was not authorized to enter into a certain contract with the Hydro-Electric Power Commission of Ontario for the purchase of electric energy at Niagara Falls, which contract is referred to in report No. 13 of the Board of Control, dated May 4, 1908, adopted by the said Municipal Council, and in by-law No. 5,138.

"And also for a declaration that the defendants are not authorized under the by-law of the defendants, No. 4,834, on the 28th day of January, A.D. 1907, or otherwise to enter into a contract with said Commission for the purchase of electric energy save upon the terms set forth in said by-law.

"And also for a declaration that the said contract was obtained by misrepresentation, and that the same is not binding and should be set aside.

"And also for a declaration that the defendants are not authorized or empowered to construct a plant for the distribution of electricity in the said city owing to existing rights and franchises.

It is possible on account of a legal requirement that the writs will not be returnable at the coming fall assizes, as the applications were put in too late. If this is the case, they could not be heard before January next. Mayor Oliver of Toronto, when spoken to in regard to the matter, stated that the city would simply go ahead and get everything ready. If anything is wrong, he supposed, the Government would make it all right. As for the city itself, it would fight the application. It had not signed any contract which it had not a right to sign. The city would take this position and was determined to go right ahead.

In the Pearson writ a declaration is asked that neither the City Council nor the Hydro-Electric Commission had any "lawful right or power to enter into a contract to create a debt against the ratepayers" or "to enforce any obligation on the ratepayers to pay taxes." It is also asked that any contract already entered into be declared unlawful and void. An injunction is asked restraining any proceeding under these by-laws.

The claim is made in the writ that the Electrical Development Company and the Toronto Electric Light Company "are now lawfully entitled to hold and operate their franchises vested in them." The writ states that the Electrical Development Co. as a result of the ratification of the agreement with the commissioners of the Queen Victoria Niagara Falls Park raised $10,000,000 on debentures and built a permanent plant and a transmission line from the Falls to Toronto. The Toronto Electric Light Company, it is set forth, on getting its franchise from the city of Toronto, borrowed $7,000,000 and expended it in their undertaking to supply light and power.

"The Toronto Electric Light Company," says the statement of claim, "are also entitled to hold and operate their franchise free from competition by the city, on the grounds that the city cannot lawfully derogate from or depreciate the value of the said franchise for the supply and distribution of light and power during the said period of thirty years, and that the city is by law bound to offer to purchase the property and plant of the company and proceed to arbitration therefor before they engage in the construction of a duplicate and competitive system."

Mr. Pearson's writ makes the Hydro-Electric Commission a party as well as the city of Toronto. Under the present legal regulations the plaintiff would have three months in which to serve his statement of claim. Eight days will then be given for the statement of the defence and three weeks later the action may be brought to trial.

In connection with the issuance of these writs several communications have been published in the Toronto press, the principal being one from Mr. J. J. Wright, Manager of the Toronto Electric Light Co., and one an interview with Mr. Robert A. Ross, of Montreal, Consulting Engineer to the Hydro-Electric Commission, who was recently in Toronto. Mr. Wright's communication was to the effect that the easement plan upon which the Commission intended to construct its transmission line was a serious menace to the farmers over whose property the line would pass. He pointed out also that the Toronto & Niagara Company had been granted a charter in 1902 with an express provision that they should fence in the transmission line.

Mr. Ross in reply to this stated that the danger would be extremely small and in fact almost negligible. The fencing in of the Toronto & Niagara Company's transmission line, he stated, was the result of the Company being a pioneer.

Mr. F. H. McGuigan, who obtained the contract for the construction of the transmission line, stated that the injunction proceedings would not affect his plans in the slightest. The Company had options on all the material required and were not afraid of any increase in case of delay.

Personal.

Mr. F. B. Lavender, C.E., Toronto, has been appointed Superintendent of the Bowmanville electric light plant.

Mr. William Perry has opened an office as a consulting and hydraulic engineer at Maplewood Avenue, Cote des Neiges, Montreal.

Mr. A. W. Ellson Fawkes, of Montreal, Que., is stationed at Campbellford, Ont., where he has control of the erection of the new power house.

Mr. Franklin H. Reed, who for a number of years has edited the American Telephone Journal, will be the editor if the new consolidated paper, Telephony.

The Senate of the University of New Brunswick has appointed Professor E. A. Stone, late of Dalhousie University, to the position of Dean of the Engineering School.

Mr. George C. Rough, sales manager for the Packard Electric Company, St. Catharines, Ont., returned recently from a trip to Winnipeg and the coast, and reports conditions in the West steadily improving.

Robert H. Day, the electrical expert, who has been in St. John, N.B., for some few weeks in the interests of the Board of Fire Underwriters, has completed his investigations there and returned to Hartford, Conn.

Mr. C. H. Abbott, who was for some years with the R. E. T. Pringle Company at St. John, N.B., has joined the staff of the Packard Electric Company, St. Catharines, Ont. He will be attached to their Winnipeg office as travelling representative.

Mr. C. H. Mitchell, consulting engineer, Toronto, returned a short time ago from the west, where he was engaged in a preliminary investigation for the Creston, B.C., Light and Power Company. Professional duties also took Mr. Mitchell to Calgary and Vancouver.

Mr. Louis Yorston, B.Sc., construction engineer of the Montreal Light, Heat & Power Company, Montreal, in company with his brother, Mr. Fred Yorston, editor of the Standard, Montreal, paid a visit to his father, Mr. James Yorston, at Picton, N.S., recently.

Mr. S. Edwards, who for the past two years has been superintending the Government telephone lines in Alberta, has resigned his position with the Government and will return to Winnipeg and assume the managing directorship of a company there, in which he is a large shareholder.

Mr. A. McLean, Canadian Trade Commissioner in in China, recently underwent three operations in the hospital at Shanghai, but has recovered and is attending to his duties. Mr. McLean, who is seventy years of age, has numerous friends in Canada, but especially at Ottawa, where he was at one time an alderman, representing Victoria ward.

Mr. H. W. Price, of the electrical engineering department of the University of Toronto, has invented an automatic safety signal for preventing railway collisions. The device has been taken up by a company known as the Universal Signal Co., Limited, which will manufacture the signal and place it before the public. John A. Street & Co., bankers and brokers, Toronto, are promoting the company.

A rural telephone company is being organized by the farmers north of Canora, Sask. Work on the construction of the lines is to be commenced at an early date. Lewis Simes is interested.

The Provincial Government will erect a new telephone exchange at Portage la Prairie, Man., this fall at a cost of about $25,000. Orrin F. French is Chief Engineer, Department of Telephones, Winnipeg.

R. H. Sperling, Vancouver, B.C., General Manager, B.C.E.R., announces that the directors of the British Columbia Electric Company have passed appropriations for the province for the year beginning in September amounting to $4,280,000, and that the construction of a new office building and freight shed in Vancouver will be immediately commenced. The cost of the new office building will be $200,000.

Sparks.

Application is being made by the Toronto Suburban Railway for a 25-year extension of its franchise and for the right to extend its line through Swansea to the Lake Shore Railroad.

Arrangements have been completed for the extension of the B.C. Electric Railway Company's lines up the Capilano Valley, B.C., to the second canyon. The line is to be in operation by next spring.

Plans are being considered for the reconstruction of the power plant of the Togona Water & Light Company at Sault Ste. Marie, Ont., destroyed by fire in May. J. S. Wynn is acting manager.

The Lethbridge City Council have decided to submit a by-law to the ratepayers for the purchase of the electric plant of the Lethbridge Electric Company. The extension and removal of the plant will cost $100,000.

The electric lighting plant at Leamington, Ont., owned by Messrs. Stars, Reid & Post, has been sold to Detroit capitalists. The price paid is said to have been $25,000. The new owners intend to make extensive improvements in the plant.

The City Engineer of St. Thomas, Ont., has presented to the Council an estimate of the cost for extending the municipal street railway system to Port Stanley, a distance of seven miles. The cost will be $51,200 exclusive of equipment, to which must be added $11,000 for overhead work.

Plans are being considered at Port Arthur, Ont., to construct transmission lines to Kakabeka Falls, a distance of 24 miles, build a belt line railway and also double track the railway system in the near future. W. P. Cooke is chairman of the Electric Railway, Light and Telephone Commission, Port Arthur.

MOONLIGHT SCHEDULE, FOR OCTOBER.

(Curtesy of the National Carbon Company, Cleveland, Ohio.)

Date.	Light.	Date.	Extinguish.	No. of Hours
Oct. 1	6 10	Oct. 2	5 10	11 00
2	6 10	3	5 10	11 00
3	9 50	4	5 10	7 20
4	11 00	5	5 10	6 10
6	0 10	6	5 20	5 10
7	1 30	7	5 20	3 50
8	2 40	8	5 20	2 40
9	No Light	9	No Light	
10	" "	10	" "	
11	6 00	11	8 20	2 20
12	6 00	12	9 00	3 00
13	5 50	13	9 40	3 50
14	5 50	14	10 20	4 30
15	5 50	15	11 10	5 20
16	5 50	17	0 10	6 20
17	5 50	18	1 00	7 10
18	5 50	19	2 00	8 10
19	5 50	20	3 00	9 10
20	5 40	21	4 00	10 20
21	5 40	22	5 00	11 20
22	5 40	23	5 30	11 50
23	5 40	24	5 30	11 50
24	5 40	25	5 40	12 00
25	5 40	26	5 40	12 00
26	5 40	27	5 40	12 00
27	5 30	28	5 40	12 10
28	5 30	29	5 40	12 10
29	5 30	30	5 40	12 10
30	5 30	31	5 40	12 10
31	5 30	Nov. 1	5 40	12 10
			Total............	239 10

Sparks.

The Wetaskiwin, Alta., ratepayers have voted $12,000 for improvements to the municipal electric lighting plant.

Quinlan & Robertson, Montreal, have obtained the contract for the steel and concrete dam above the Chaudiere Falls, Ottawa, at a cost of $250,000.

D. W. Ackerman, Midland, Ont., has obtained the contract for supplying 500 h.p. to the municipal lighting plant for a term of ten years at $17 per h.p.

Wire & Cable Company, Montreal, have obtained an extra provincial license in British Columbia, with provincial head office at Vancouver. H. H. Abbott, is attorney.

Application is being made by the Toronto Suburban Railway for a 25-year extension of its franchise and for the right to extend its line through Swansea to the Lake Shore Railroad.

The Prince Rupert Power & Light Company, Limited, with capital of $25,000 and power to increase it to $50,000 by March 16th, 1908, has been incorporated to construct a power plant at Woodworth Lake.

The Northern Electric & Manufacturing Company, Montreal, have obtained an extra-provincial license in British Columbia, with provincial head office at Vancouver. H. W. Kent, Vancouver, B.C., is attorney.

The Lethbridge City Council have decided to submit a by-law to the ratepayers for the purchase of the electric plant of the Lethbridge Electric Company. The extension and removal of the plant will cost $100,000.

The organization of a new electric power company, capitalized at $100,000, at Horning's Mills, Ont., is mooted. It is proposed to develop the Huxtable power at Horning's Mills for both lighting and power purposes.

The Robb Engineering Company, Limited, head office at Amherst, N.S., have obtained an extra-provincial license in British Columbia, with head office at Royal Bank Chambers, Vancouver. Hon. Sir Charles Hibbard Tupper, Vancouver, is attorney.

The Winnipeg Electric Company have a large gang of men at work enlarging the channels at Lac du Bonnet to increase the water power of the electrical development plant. An engineer estimates that fully 100,000 h.p. can be developed on the river here. This energy is used to operate the company's cars and also supply Winnipeg with electricity.

The City Council at Edmonton are making arrangements for the construction of an electric street railway system to run there and in the City of Strathcona on the opposite side of the Saskatchewan River. Edmonton has secured the charter of the Strathcona Radial Tramway Company. Arrangements provide for the building of a small system this summer which will be materially extended next year.

Tenders are being taken by the Hydro-Electric Power Commission for transforming station. The stations will be twelve in number, and will be built at the following point: Niagara Falls, Dundas (combined transformer and interswitching), Toronto, Brantford, Woodstock, London, Guelph, Preston (supplying Galt and Hespeler), Berlin (supplying Waterloo and New Hamburg), Stratford, St. Mary's will depend upon the passage of the Stratford by-laws. The McGuigan Co. will not tender.

Sparks.

The contract for motors in connection with the Edmonton street railway system has been awarded to the Canadian General Electric Co., of Peterboro.

A Victoria, B.C., report states that the B. C. Electric Railway Company are considering the bringing of electricity from the mainland across the Gulf of Georgia.

The Kootenay Development Syndicate have been granted a license by the Provincial Government of British Columbia to develop and distribute electrical energy.

Lighting struck the transformer house of the Falls Power Company at St. Catharines, Ont., last month, and did damage to the extent of about two thousand dollars.

The by-law to raise $7,000 in connection with improvements to the electric light plant at Wingham, Ont., has been approved by the Ontario Railway and Municipal Board.

J. McTeigue, city clerk, Port Arthur, Ont., recently took tenders for the construction of a concrete dam at Onion Lake, on Current River. Smith, Kerry & Chace, consulting engineers, Toronto.

The British Insulated & Helsby Cables, Limited, have just obtained a contract from the Montreal Light, Heat & Power Company for an additional four miles of three core extra high tension cable, to be installed immediately.

Allis-Chalmers-Bullock, Limited, Montreal, have secured the contract to enlarge the municipal lighting plant at Calgary, Alta., with a 750 k.w. alternating current generator, 30 k.w. excitor, switchboard and other auxiliary apparatus.

Arrangements are now being completed at Windsor, Ont., to organize a company to build an electric railway to Detroit, Mich., by way of the Michigan Central Railway tunnel. J. A. Smith, Dr. Revell, A. J. Nelles, G. L. Leggatt, W. Bong, of Windsor, Ont.; G. Bonteiller, of Walkerville, Ont., and G. King, of Detroit, Mich., are interested.

Sparks.

The ratepayers of Morden, Man., are to vote on a by-law to raise $10,000 for electric light purposes.

A by-law to raise $3,000 for the construction of a telephone system has been carried at Revelstoke, B.C.

The city of Edmonton, Alta., has purchased the 33-year franchise of the Strathcona Radial Tramway Company.

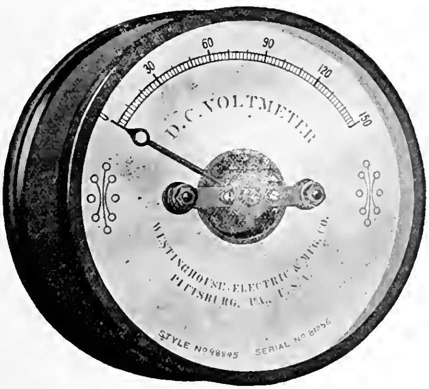
The Killarney, Man., ratepayers have approved a by-law granting a franchise and bonus of $2,000 to George Collison, who will establish an electric light plant there.

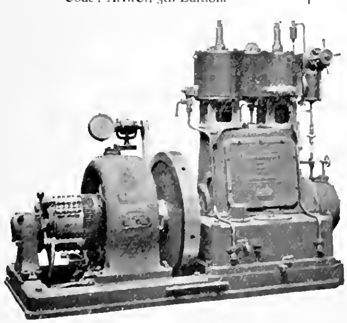
Notice has been given that an application will be made to the Legislature at its next session for permission to build an electric railway from Belleville, Ont., to Point Anne, a distance of about five miles.

The Creston Power, Light & Telephone Company has been incorporated, with a capital stock of $20,000, and the following officers elected: George M. Benny, president; James Compton, vice-president; Guy Lowenberg, secretary and treasurer.

La Compagnie des Eaux et d' Electricite de Saint Felicien Limitee, capital $99,000, has been incorporated to construct an aqueduct in the village of Saint Felicien, Que. Incorporators, A. Naud. P. Jalbert. P. A. Potvin and others of Saint Felicien.

The project for the construction of an electric railway from Dunnville, Ont., across the Niagara Peninsula is reported to have been revived. The line now proposed will run from Dunnville by way of Wellandport and St. Ann's to Beamsville and connect with the Hamilton, Grimsby & Beamsville Electric Railway. Jas. A. Ross, Wellandport, is president.





Short Circuits.

The Hamilton Fire and Water Committee will take tenders on synchronous motors of 66 cycles for the Beach pumping stations.

Tenders will be received by M. Peterson, Secretary Winnipeg Board of Control, until September 15th for electric lighting plant and carbons. Specifications and further details may be obtained of F. A. Cambridge, City Electrician, Winnipeg, or of Mr. Peterson.

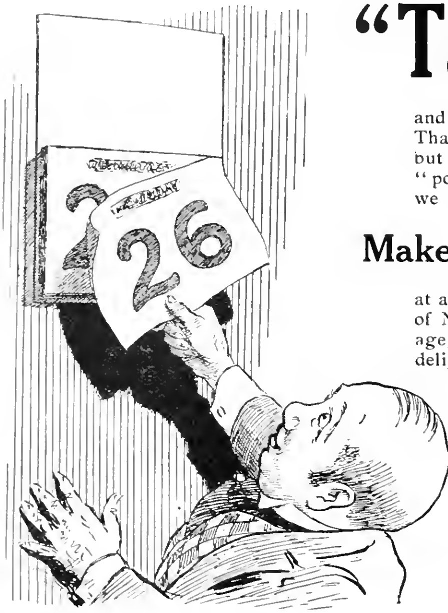
W. A. McKay & Company, electrical contractors, Sydney, N.S., have secured a contract with the Newfoundland Government for the electrical work in connection with the museum at St. John's, Newfoundland. They have also made a contract with the Canadian Government for the electrical work in conection with the new Government building at Shelburne, N.S.

The Interurban Electric Company, Limited, has been incorporated to operate in the municipalities of West Toronto, Township of York, Toronto, Township of Etobicoke, and the Township of Toronto. The company is authorized to operate steam and electric railways, telephone systems and to generate electricity for lamps, heat and motors. It has also authority to purchase or take over the Stark Telephone, Light & Power System, Limited. The company is capitalized at $400,000, and the directors are: Eli Smith Edmanson, Fred Grundy, Alfred Neville Morine, Mervil McDonald, Charles Herbert Porter, George Deleno Lewis and George T. Turnbull.

Estimates are being prepared by the engineers of the Hydro-Electric Power Commission of the cost of power in response to applicants from Whitby, and other points east of Toronto, who desire to share in the service from Niagara Falls. It is said that deputations from the towns will wait on the Commission in order to place themselves in a position to submit the power by-laws to the people in January. It was said that the Electrical Development Company was contemplating an extension of its line eastward, and probably a continuation of the Scarboro Electric Railway to Whitby would be promised. This is denied by Sir Henry Pellatt, president of the power company.

Situation Vacant

Wanted—Desirable party with some capital to go into partnership with an established electrical manufacturers agent in Toronto. Strictly confidential. Apply Box 100, Electrical News, Toronto.



"Take a Day off"

and gather up your burned out incandescent lamps. That may look like a loss of time on the face of it, but whether you have a large or small business it is "positive waste" to throw away your burn-outs when we can refill them, and

Make Them "Brand New" Again

at a low cost. Lamps refilled by us stand all the tests of NEW HIGH GRADE LAMPS for long life, voltage, candle power, and general appearance. You'll be delighted with the results.

Let us tell you about our proposition, and the easiest way to ship. Remember we give a POSITIVE GUARANTEE OF PERFECT SATISFACTION.

The Dominion Electric Co.
St. Catharines, Ontario

Why Patronize the "Lamp Trust" When You Can Buy in the Open Market

The Gilbert Arc Lamps are renowned throughout the Empire as the highest type of arc lamp perfection. They're made in Great Britain, which guarantees that they are well made.

If you want "Something better" than you now have get acquainted at once with the

GILBERT ARC LAMPS

Made in every style and size, and not so costly as the "trust" lamps.

Endorsed and used by the British Admiralty, War Office, India Office, Thames Embankment, Manchester and sixty other leading Corporations.

J. F. B. VANDELEUR, Canadian Representative

Repair Shops in Toronto 3 Dineen Building, **Toronto**

Continuous Wire in Mouldings.

The Canadian Fire Underwriters 'Association have issued Bulletin 17 embodying the amendments and additions to the national code which were adopted at the last convention held in New York. Two important points which the underwriters intend to devote particular attention to, are the adoption of the rule calling for continuous lengths of wire in mouldings with approved fittings for splices and the proper installation of main line service switches. Chief Electrical Inspector H. F. Strickland, of Toronto, calls attention to the fact that the old rule calling for main line switches to be placed immediately at the entrance is now broadening, so that they are placed in the most convenient location near the point of entrance. This will enable switches to be placed in suitable iron service boxes near the main entrance to buildings, so that current can be, and is likely to be, cut off at night. The underwriters are now preparing bulletin 18, with drawings illustrating this method. Mr. Strickland considers the proper interpretation of this main line switch rule and its universal adoption to be a potent factor in reducing the fire loss from electrical causes to a minimum. Hundreds of short circuits and minor electric fires take place during the day time, but, being promptly discovered, do not as a rule amount to anything serious. It is during the night that minor fires reach major proportions, and this is what the new rule is specially provided to guard against.

Trade Enquiries.

The Dominion Government Trade and Commerce reports contain the following trade enquiries. Readers of the "Canadian Electrical News" may obtain the names of enquirers by writing us. State number of enquiry:—

1391. **Representatives.**—A west of England firm manufacturing portable electric tools, electric hoisting and transporting appliences, etc., desires to appoint representatives in Canada.

1498. **Representative.**—Inquiry has been made by a consulting engineer at Liverpool for the names of some and transporting appliances, etc., desires to appoint representative in Great Britain and to whom his experience would be of service.

1508. **Agency.**—An English firm of electrical engineers manufacturing generators, motors, fans, switchboards, starting switches, arc lamps, cables, fittings, accessories, bells, telephones, etc., desires to hear from some Canadian firms willing to take up their agency.

The following is among the recent enquiries relating to Canadian trade received at the office of the High Commissioner for Canada, 17 Victoria street, London, S.W.:

Inquiry has been received from an old established firm manufacturing an oil-gas apparatus suitable for lighting villages, country houses and places out of the way of ordinary gas supplies, for the names of parties in Canada who would be prepared to take up their agency.

Personals.

Mr. W. G. Chace, of Smith, Kerry & Chace, has gone to Winnipeg to attend to his firm's interests in connection with the Municipal Power plant, and to represent the firm generally there. Mr. Chace will be greatly missed by his Toronto confreres.

Mr. Ormond Higman, chief of the electrical branch of the Inland Revenue Department, Ottawa, is at present in England, and will represent the Dominion Government at the International Congress of Electrical Units, to be held in London this month. He will also be present at a similar congress to be held at Marseilles, France. Mr. Higman is expected to return early in November.

The Mageau Leblanc Lumber Company, Ltd., of Chapleau, Ont., have sold their property, consisting of one hundred acres of land, a modern sawmill with a capacity of 30,000 feet a day, and an electric light plant and powerhouse, with a ten years' franchise from the town, to Mr. J. A. Fortin, former manager of the company. The new owner has started to install planing machinery and will manufacture every kind of planing lumber. We are informed that the price paid was about $30,000. The new business will be carried on under the name of the Chapleau Electric Light and Power Company. The "Electrical News" wishes the new owner every success.

In addition to the exhibit of the Canadian Electrical & Motor Company in Machinery Hall at the Canadian National Exhibition, which was described in our last issue, this company had a 25 K.W. belted type, 125-volt generator, manufactured under the H. A. Johnson patents, operated by a gas engine, in the exhibit of the Canadian Gas, Power and Launches, Limited, in the Process Building. The company also had another exhibit in the Process Building, where one of their 75 H.P. direct current generators was directly driven by flexible coupling attached to a Weber 75 H.P. 280 revolution, upright, 2-cylinder gas engine., which in turn was supplied by a Weber gas producing generator. A multispeed motor was also shown in operation in this exhibit. The operation of these motors without rheostats, and the short circuiting of the generators attracted a great deal of attention.

Sparks.

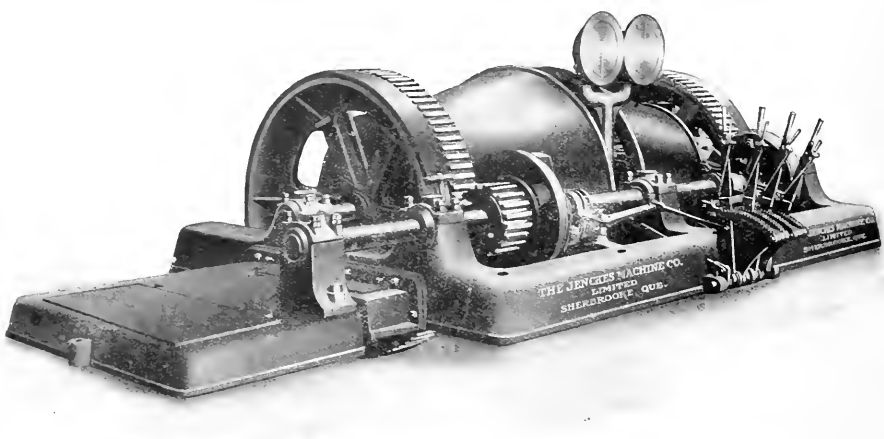
R. H. Sperling, general manager B. C. Electric Railroad Company, Vancouver, states that street car extensions will be constructed through Hastings upon receipt of a bonus of $51,000.

The Norwich, Ont., village council have renewed the lighting contract with H. Webster for one year in the hope of getting power from the Hydro-Electric Commission and of taking over the plant.

Arrangements are now being made to put a by-law before the ratepayers of Fernie, B.C., to provide sufficient money to rebuild and operate the Crow's Nest Electric Light & Power Company's system as a municipal enterprise.

A company is being organized south of Estevan, Sask., to construct a rural telephone system with eleven miles of wires to be strung this fall, and more added in the spring. Connection will be made with Estevan by a long distance line. W. C. Howland, Estevan, Sask., is interested.

The Toronto Railway Company have given a contract to British Insulated & Helsby Cables, Ltd., Montreal, for supplying and installing the three-core extra high tension feeders in connection with the new extensions which they have on hand. The British Columbia Telephone Company also have placed an order with British Insulated & Helsby Cables, Ltd., for over forty miles of air space telephone cables, ranging in size from 400 pair to 25 pair.



Electric Hoists

Single or Double Drum.
In any capacity, for any depth.
Furnished with or without motors as desired.
Illustrated Bulletin sent on request.

The Jenckes Machine Co. Limited

General Offices : Sherbrooke, Que.

Works: Sherbrooke, Que. St. Catharines, Ont.

Sales Offices: Sherbrooke St. Catharines Cobalt Rossland Vancouver Halifax

---

Can Ship Immediately

Peterborough

Integrating Wattmeter

For Alternating Current

Dust, insect and moisture proof.
Is correct on all loads from two per cent. of its capacity to fifty per cent. overload.
Will run continuously and accurately on fifty per cent. overload.
Has no complicated parts, and the friction is reduced to a minimum.

Write for Prices and Bulletin "B"

Sole Selling Agent

John Forman

Electrical Supplies
248-250 Craig Street West, Montreal, Que.

Canadian
Electrical News
& Engineering Journal

PUBLISHED ON THE FIFTH OF EVERY MONTH BY
HUGH C. MACLEAN, LIMITED,

HUGH C. MacLEAN, Winnipeg, President.
THOS. S. YOUNG, Toronto, Business Manager.
JAMES FISHER, Toronto, Advertising Manager.

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362
F. W. SCHERBARTH, Representative.

MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative

WINNIPEG - - - - Telephone 224. 404 Travellers Bldg
ROLAND F. HILL, J. R. HOOPER, Representatives.

VANCOUVER - Telephone 2248. Molsons Bank Chambers
GEO. A. GALL, Representative

ADVERTISEMENTS.

Advertising rates sent promptly on application Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.

The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

The Tirrill Regulator

From time immemorial it has been recognized that close voltage regulation was a most desirable feature in all constant potential plants, in view of which designers without number have tried first one scheme and then another in an endeavour to produce a satisfactory automatic voltage regulator. That a constant delivered voltage is most important is shown by the fact that without really close regulation you cannot use high efficiency lamps, and without high efficiency incandescent lamps the central station would be greatly handicapped in competing against gas. Further, bad regulation means fluctuating light, which, in turn, means complaints from customers, another great handicap. Besides this, low voltage, occurring as it so naturally and so frequently does, just when the greatest number of lamps are burning, means considerably less output than might otherwise be secured, and hence a corresponding reduction in revenue.

The regulation of generator voltage is practically always accomplished, as everyone knows, by varying the field strength of the machine in question, aided sometimes by a change in the speed. In all the earlier plants the only mechanism for doing this consisted of the field rheostat, the operator to turn it in or out, and the ammeter which gave him an indication of the load he was carrying. Later on he was given the aid of pressure wires, which showed him the voltage at the centre of distribution, these afterwards being supplemented by the line drop compensator, an instrument which accomplished the same purpose in a much neater manner. This latter, in combination with a good operator, represents about the highest development of hand control. Naturally, it is far from being really satisfactory, as no man can be expected to catch all the sudden load changes in a plant, hence there was every inducement for the development of an automatic equipment which would do the required work

The gentleman who was lucky enough to hit upon a most satisfactory device for this purpose is Mr. A. A. Tirrill, who is now widely known as the designer of that most excellent regulator which bears his name. The principle of this ingenious instrument is simply that you can cut out a field rheostat, and thus raise the generator voltage, by merely shortcircuiting the rheostat, just as well as by the usual method of turning the handle. Conversely, the rheostat can be cut into circuit and the generator potential lowered, by opening that shortcircuit, just as well as by turning the handle in the other direction. Obviously, if you repeat these two operations very quickly, one after the other, you will obtain an average effect, getting a higher potential as you increase the length of time you leave the shortcircuit closed, the potential being lowered if you increase the time that the shortcircuit is removed. The Tirrill regulator is simply an apparatus for repeating these two operations, with means for varying the two periods occupied by them, the shortcircuit round the field rheostat being made by two platinum contacts, set only about 1-16 of an inch away from each other, and controlled by electro-magnets. These contacts are continually vibrating at quite a high speed, the actual rate, and therefore their average effect upon the field of the exciter, being varied by the controlling magnets, these latter consisting in the main of a direct current winding, energized from the exciter bus bars, and an opposing winding excited from the potential to be governed. As the latter gets lower than normal its magnet naturally weakens, allowing the shortcircuit to close, the resultant increase in the exciter voltage opening the contacts as soon as its magnet gets strong enough to overcome the a.c. pull. If it be desired to raise the voltage with increasing load a third or current winding can be put on to the control magnet, connected so as to neutralize the alternating potential winding, thus requiring a higher and higher alternating voltage to balance the magnet pull resulting from the increase in the load. If it be desired to give a constant pressure at a centre of distribution the regulator can be actuated from a line drop compensator, instead of the generated a.c. potential.

As a general rule the regulator finds its largest use in connection with alternator control, in which case it is always connected to work on the exciter, the alternator field rheostat being left out of circuit, but it can be used with equal facility on direct current machines. In fact, besides including all kinds of generator regulation, it is often used at the ends of different transmission lines emanating from a common power house, in conjunction with synchronous motors, to obtain the required delivered potentials. Further, it can be modified so as to govern for constant watts, constant power factor, etc., instead of constant voltage, from which it will readily be seen that it is a device that is capable of many interesting and valuable modifications, and hence one which is bound to find a wider and wider field of usefulness. Naturally, it has not been brought to its present state of perfection without having had a tremendous amount of time and money spent upon it, so much so that Mr. Tirrill has doubtless often felt tempted to abandon it. One of the very great objections to all other forms of regulators that had come on the market was their great inertia, both mechanical and electrical, and hence a great tendency to hunting. This is entirely absent in the Tirrill regulator, because the moving parts, being very small, respond very quickly to even the smallest change in the voltage, and because the effect on a generator field of entirely short-circuiting a field rheostat is much more instantaneous than can be obtained from a movement of the rheostat handle. Besides all this, the instrument is somewhat more efficient than the ordinary systems of alternator control, as there is no alternator field rheostat to introduce quite a heavy and constant loss. It can be adapted to any combination of direct or alternating current generators, run singly or in multiple, and to any arrangement of exciters, and on the whole it is without doubt one of the most valuable central station auxiliaries which have been put on the market for some time.

The Prevention of Accidents

Many of our readers will doubtless have been deeply interested in an article which appeared not long ago in the Engineering Magazine on the subject of safety devices. Such a matter as this naturally becomes more important every day, seeing that the density and the pace of all kinds of traffic are always on the increase, be it on steam or electric railroads, or on the pavement or the sidewalk, and that machinery is everywhere aiding or supplanting the human hand. Recognizing these facts, and the great necessity for safeguards of all descriptions, which is naturally produced by such a change in the world's conditions, various philanthropic and manufacturers' societies in Europe have established museums for the exhibition of all new types of safety devices, and the preservation of old ones. The last institution of this type to be opened is in Paris, France, where there may now be seen a most complete collection of devices intended to safeguard the worker in practically every walk of life. It would naturally be quite impossible for us to present even an epitome of the description given by our contemporary in the space available. Suffice it to say, that all electrical men, if they had the opportunity of visiting it, would find numberless devices relating to the generation and use of electricity, and therefore of absorbing interest to them. For instance, taking those who are operating by steam, there are water gauges which will not hurt you if they burst, as the glass cannot fly, nor can the hot water and steam spread all over the room. Then there are numerous types of speed limiting devices, or governors, to prevent engines or waterwheels attaining to dangerous speeds; various kinds of safety valves and other protective devices for boilers, specimens of corroded plates, etc. Then, turning to the purely electrical side, there are to be seen many different arrangements for the prevention of electrical shock, linemen's safety harness, etc. One other article which we cannot help mentioning here, though it applies to a tool that is found perhaps less in electric plants than in many other industries, is a guard which it is claimed will positively prevent damage from a bursting emery wheel.

It is, of course, impossible to expect in a much younger, and therefore a more rough and ready, country like ours, that matters like this would be carried to the point which they reach in the old world, still are we not fast approaching the time when the matter should be taken up fairly seriously by Canadians? Our manufactures are growing, our electric light plants are extending, and with this increase in the use of machinery must inevitably come a great increase in the number of accidents unless steps be taken to decrease the possible sources of trouble. As a matter of fact, a move has been made towards this end in the States, a museum very much along the lines of those on the Continent having recently been opened in New York. Until something similar be started in Canada, let us keep our eyes open for all protective devices, and do our best, both now and afterwards, to maintain the good name of electric light and power as one of the best and safest servants that man can possibly have, by the most careful attention to all the various points, both in the power house and on the circuits, where danger to life or property might ensue as the result of neglect or the use of improper or defective apparatus. If properly generated and properly distributed, electric energy has no real competitor. Do your part to see that the plant in which you are interested is a thorough exponent of that fact.

It is stated that the offer of the Winnipeg Electric Company to supply electricity to the city at $18.40 per h.p. was not based on a meter rate, but on a 24-hour rate. Under the contract submitted by the company the city would be compelled to take 10,000 h.p. annually whether it was used or not, at a cost of $184,000 per year. In addition, the city would have to build a distributing plant. F. E. Cambridge is City Electrician.

No Credit Squeeze This Year.

The enforced reduction of mercantile credits last year did much to bring about the pinch. The bankers of the country hold the view that the reduction was simply in the nature of a quinine pellet to a patient who otherwise would have died of the fever of over-speculation and too rapid development. The August bank statement, issued recently, shows that the medicine has proved effective. In August, 1907, bank deposits decreased $3,286,000. This year they increased during August $15,673,000, while deposits elsewhere than in Canada decreased only $1,815,000. The total deposits in Canada of Canadian banks are now $583,429,000, or just $2,757,000 less than a year ago. On the other hand, the current and call loans in Canada are $557,415,000, while in August, 1907, they were $627,840,000. In round figures, the slackening in business activity and in speculation is represented by a decline of seventy millions in loans to the public. If deposits continue to pile up as they are doing, the bankers will be forced to loan more freely in order to pay interest and dividends. There may be a momentary curtailment of credits while Western wheat is moving, but after that there must be an extension of credits. The logic of events will force it. —Toronto Globe.

The British Consul-General for Peru reports a possible market there for machinery, railway material, telegraph and telephone wire, and electrical appliances. In regard to electrical appliances, however, he adds that the market is very limited. In Lima there are electric tramways, urban and suburban, and an electric light plant. Electric power is very little used for industrial purposes; a 100 horse-power per hour costs £1 1s. 6d. Light for private houses is expensive, 16 candle-power lamps cost about 8d. per kilowat hour. Moreover, the Santa Rosa Electrical Company have a clause in their concession which stipulates that no consumer can use any appliances which they (the company) do not provide. The tension of current supplied by this company is subjected to great variations, so that lamps are continually being burnt out and the light is very unsatisfactory. It is estimated that there are 23,090 lamps actually in daily use in the town of Lima.

Toronto Section A.I.E.E. at Niagara.

The Toronto section of the American Institute of Electrical Engineers held an enjoyable excursion on Saturday, Sept. 19th, to Niagara Falls, for the purpose of visiting the various power plants there. About a score of members were present and a very enjoyable trip was had.

The party left on the 7.30 a.m. steamer and arrived at Queen Victoria Park, Niagara Falls, at 11 o'clock. They were then taken in charge by Mr. Symes, of the Electrical Development Co., who conducted them over that company's generating plant. Next they visited the transformer stations of the Toronto-Niagara Falls Power Co. and the Canadian Niagara Power Co., after which they enjoyed a pleasant luncheon at the Clifton Hotel.

In the afternoon the generating station of the Canadian Niagara Power Co. was first visited, after which the party was taken in charge by Mr. W. N. Ryerson, of the Ontario Power Co., who conducted them through that company's generating and distributing station. The party then commenced the homeward trip and reached Toronto at 8.30 p.m.

The excursion was a most instructive one from many points of view, and the members were able to obtain a good idea of the extent of the power development on the Canadian side at Niagara.

A pleasant feature of the day was a presentation to Mr. W. G. Chace, of the firm of Smith, Kerry & Chace, who will shortly leave for Winnipeg. Mr. Chace has filled the office of secretary of the section most acceptably, and the appreciation of the members was expressed by the presentation of a handsome black leather satchel. Mr. Chace made a brief reply, expressing his thanks and the interest which he had always taken in the branch.

Saskatoon Secures Power and Light.

Saskatoon, Sask., has entered into an agreement with R. A. Taunton, of Winnipeg, to provide electric light and power for the town. Mr. Taunton's company is to be known as the Yellow Grass Electric Lighting & Power Company, and a limited number of shares are being sold to the public. The agreement is for a fifteen-year franchise and a nominal rental of the site at $5 a year. The franchise is renewable for periods of five years.

The council retains the right to purchase the plant at any time during the first fifteen years at a valuation plus a bonus for the good will. After fifteen years the council can purchase the plant at a valuation without a bonus. The council agrees to take six 500-candle-power lights for the street lighting at a price of fifty cents per light per night. Lights to be off for four days before and after each full moon.

Following are the rates agreed upon:

Houses using less than six 16-candle-power lights to pay 60 cents per light per month for summer and $1.20 per month for winter months. Where more than six lights are used 12½ cents per kilowat hour by meter. Lights are to be burning from half an hour before sunset until midnight, and during winter from 5 a.m. till daylight. The council agrees to remit two years' taxes.

The council agrees to grant facilities for the erection of poles on the streets and lanes of the town. Each pole to be erected subject to the approval of the Board of Works. The council gives Mr. Taunton an option on all power needed by the town for public purposes. Mr. Taunton agrees to commence work immediately on the construction of the plant and have it completed by Feb. 1st, 1909.

The Government of Manitoba has received an offer from the Great Falls Power Co., through its solicitor, Hugh J. Macdonald and H. M. Byllesby & Co., Chicago, to supply it with electric power at $12 per horse-power. The company's offer is for 30,000 horse-power or more upon reasonable request up to 100,000 horse-power, at a power house to be built by the company on the Winnipeg river in township 17, range 11, and to furnish the power in the form of electricity, on the generating side of the switchboard at the power house, at the price of $12 per annum per horse-power measured upon the generating units devoted to this purpose, the contract to be for a period of not less than forty years, renewable for a longer term at a price to be arranged by mutual consent.

It is estimated that the cost and interest on the bonds to build a power transmission line on steel towers from the Great Falls Power Co.'s plant on the Winnipeg river to Virden would be $41,702 per annum, or $1 per horse-power extra above the $12 per horse-power mentioned. It is calculated that the government could profitably sell power at $20 per horse-power to the farmers, under this arrangement.

The Development of the Producer Gas Plant

Improvements in Recent Years. History of the Gas Engine. An Important Factor in Fuel Saving.*

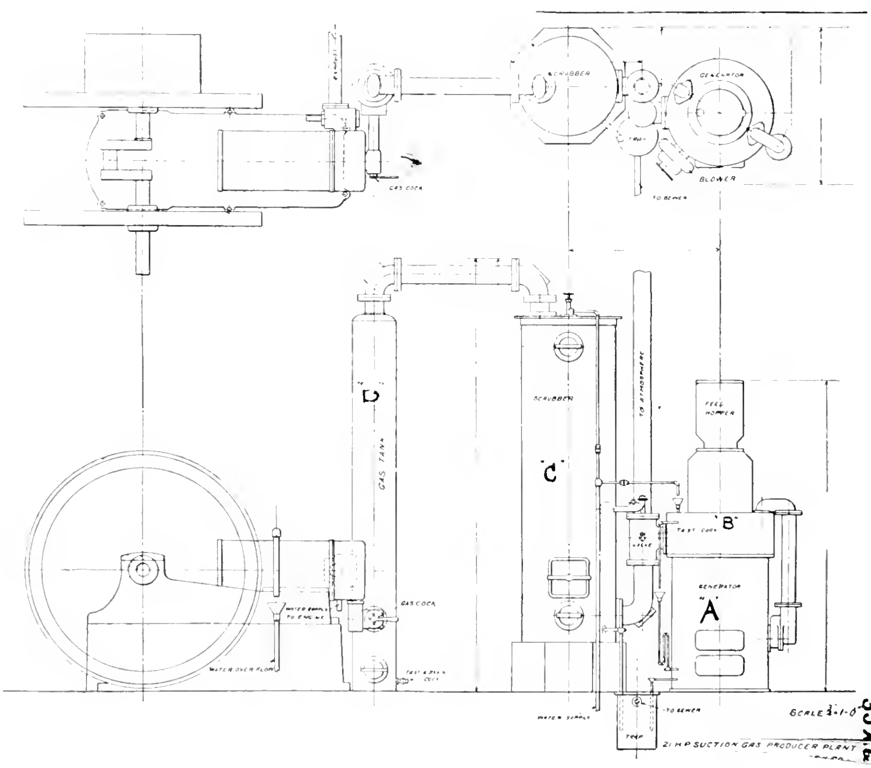
Recent developments point very positively to two factors of great importance in the economical production of power for manufacturing and transportation purposes. These two factors are the replacing to a marked extent of the steam boiler and steam engine by producer gas plants, with their accompanying internal combustion engines; and the centralization of power development and distribution.

It was only during the latter part of the nineteenth century that the gas engine found its way into the market, and, although many types have been produced in the last twenty or thirty years, it is only within the last five or six years that the development of large engines has been noted.

For many years the natural fuel for these internal combustion engines was city gas, and even this was too expensive except for engines of small capacity. It was seldom found feasible to operate engines of more than seventy-five h.p. on this fuel.

The theoretical possibilities of the internal combustion engine operated upon cheap fuel promised so much that the mechanical difficulties were rapidly overcome, with the result that steam boilers and engines in many plants were replaced by gas engines, and at the present time the internal combustion engine is rapidly becoming a serious rival of the steam engine in many of its applications.

The development of the gas engine in point of size has been exceedingly rapid. It was only six years ago that a 600 h.p. engine exhibited at the Paris Exposition was regarded as a wonder, but to-day four cycle, twin-tandem, double acting engines run as high as 6,000 h.p.



Power Plant Consisting of Gas Engine and Small Gas Generating Apparatus.

The drawing herewith shows a power plant consisting of a gas engine and a comparatively small apparatus for generating the necessary gas from anthracite coal, charcoal or coke.

The plant consists of the following:—

(a) A generator or producer in which the gas is made.

(b) A vaporizer or boiler which furnishes a small quantity of steam at atmospheric pressure.

(c) A scrubber or cooler through which the gas is passed after leaving the vaporizer.

*From a paper read by R. E. Johnson before the Canadian Railway Club.

(d) A gas tank in which a supply of gas is retained, and in which more or less moisture carried over with the gas is separated.

The fuel is fed into the generator in much the same manner as hard coal is fed to an ordinary coal heater. The principal difference being that it is necessary to prevent the admission of much air when coal is put in. There is a continuous air-tight connection from the outlet of the generator, through the vaporizer and scrubber to the engine, and the draft necessary for the formation of the gas is created by the suction of the engine. It is very necessary that all of these connections, leading from the generator to the engine and also that the generator itself, especially around its upper portion, shall be absolutely air or gas tight. The lower part of the producer is tightly closed except for one opening at which the necessary air is admitted. There is also a connection from the vaporizer to the space below the fire, so that some steam is introduced with the air. The

required for use in the scrubber and vaporizer may be estimated at three gallons per horse-power per hour.

The producer plant can be operated on a number of different fuels. Those in most common use are "pea" and "buckwheat" anthracite, foundry or gas-house coke (broken or small size), and in some cases charcoal. The relative value of different coals can be approximately determined by chemical analysis, by combustion in a coal calorimeter, or by actual test in a gas producer. With the calorimeter test the standard unit of heat is the B.T.U. defined as the amount of heat required to raise the temperature of one pound of pure water, one degree Fahr. This is equivalent to 778 foot pounds of energy, from which we find that one horse-power is equivalent to 2545 B.T.U.'s per hour.

The anthracite commonly used has a heat value of approximately 13,000 B.T.U.'s per pound.

The fuel consumption with a producer gas power plant does not exceed $1\frac{1}{4}$ pounds pea size anthracite per

200 H P. Double-acting Gas-Engine (Otto-Deutz).

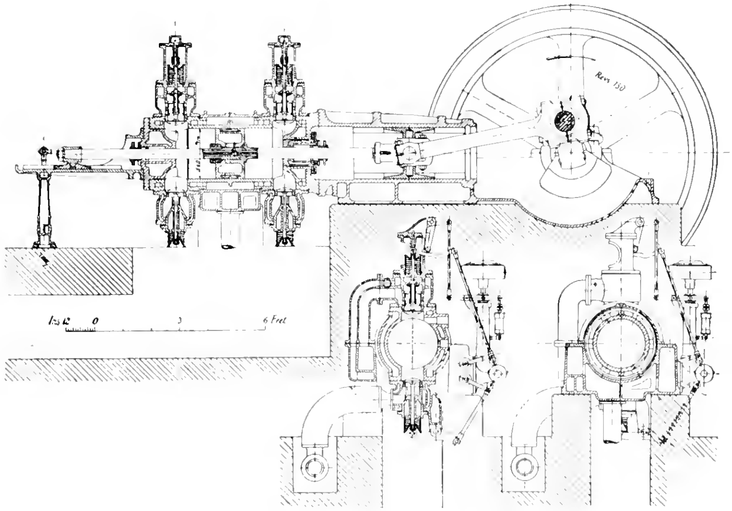


Plate No. 1.

suction of the engine draws this air and steam up through the incandescent bed of fuel, thereby causing an incomplete combustion. The steam is decomposed, forming free hydrogen and oxygen; this oxygen, together with the oxygen from the air, combines with the fuel to form carbon monoxide. The resulting gas, therefore, should be composed of carbon-monoxide and hydrogen, together with nitrogen from the air, and carbon-dioxide.

The scrubber contains a grate, and above this grate the shell is usually filled with pieces of coke about the size of an egg. Immediately above the grate some larger pieces may be used to prevent the smaller pieces from falling through. It is important that the coke be washed before putting in, to remove any dirt or dust that may be in it, and which will otherwise be deposited in the lower part of the scrubber. This coke is kept wet by a water spray at the top, and enough water should be used so that the upper part of the scrubber feels quite cool. If the gas becomes hot the engine will not work as strong. The amount of water

brake horse-power per hour, on tests run of ten to twelve hours' duration. This is equivalent to 16250 B.T.U.'s of heat supplied per brake horse-power per hour, and to a complete plant efficiency of

$$\frac{2545}{16250}=15.7$$

Tests have frequently been made with producer gas power plants, showing less than one pound of coal per brake horse-power per hour. With 13,000 B.T.U.'s per pound of coal, and 2545 B.T.U.'s converted into useful work, the efficiency of the whole plant was slightly over $19\frac{1}{2}$ per cent.

From these figures it will be evident that the foregoing statements may be considered as conservative and accurate.

The above results are better than with the very best steam plants, and several times better than the great majority of steam plants, of 200 h.p. or less.

The following table gives a clear idea of the remarkable economy of a producer gas power plant, the cost

of operation being less than one-third that of a steam plant, with the stated prices of coal.

COMPARATIVE COST OF FUEL—100 H. P. PLANTS.

For producing 100 brake horse-power, 10 hrs. per day, 310 days per year.

Type of Engine	Kind of Fuel	Cost of Fuel	Fuel Consumption per B.H.P. per hour	Cost per B.H.P. per hour	Cost per year	Saving per year using producer
				$	$	$
Simple Steam Engine	Bituminous Coal	$3.00 per ton	8 pounds	0.012	3720.00	2751.00
Gas Engine . .	Illuminating Gas	60c. per 1000 cu. ft.	18 cu. ft.	.0108	3348.00	2379.00
Gasoline Engine .	Gasoline . .	13c. per gallon	1/10 gallon	.013	4030.00	3061.00
Gas Engine . .	Natural Gas .	30c. per 1000 cu. ft.	13 cu. ft.	.0039	1209.00	240.00
Producer Gas Engine	Anthracite, Coke, or Charcoal	$5.00 per ton	$1\frac{1}{4}$ lbs.	.00313	969.00	0.00

The comparisons given in the table refer to the cost of fuel while plants are in operation under full load capacity. To these amounts must be added the cost of fuel for banking fires, raising steam in the morning, cost of boiler feed water, attendance, etc., all of which is in favour of the producer plant, and increases the saving to be made by the use of a producer instead of a steam plant.

There is a very important question still on the market unsolved and unanswered, that is, "are we always going to be able to get enough coal from the bowels of the earth to satisfy the ever-increasing demand for it?" Take for example the coal consumption in the United States for the period of 1896 to 1905, which amounted to 2,832,599,452 tons, which is nearly double the amount consumed during the previous ten years. That the fuel problem is a gigantic one is shown by the growing value of the coal mining industry of the United States. In the United States alone, in 1905 coal to the amount of 381,598,643 tons, having a value of $476,756,963, was mined. This value, compared with other mineral products in the same year, is shown by the following table:

Coal	$476,756,963
Iron	382,405,000
Clay products	149,697,188
Copper	139,795,716
Oil and gas	125,720,251
Gold and silver	122,402,683

After the coal has been exhausted, what then? Government scientists are already looking for a successor foar coal, but so far as we know coal is the only fuel worth considering in connection with the world's future supply. It must continue to be the fuel of the future, as least, so long as it is within our reach, or until other means of power production shall supplant it.

The results of recent tests have shown that we are mere babes in the woods when it comes to getting efficiency out of coal. The waste of energy of coal in the ordinary steam boiler is tremendous, it being calculated that only from five to seven per cent. of the energy of coal is transformed into actual work. The remaining 93 to 95 per cent. is consumed in the transformation. During their tests in the U. S. Government station at St. Louis, Mo., the experts got from two to nearly two and one-half times as much power from coal in a gas producer as from the same coal under a boiler. With the most modern equipment in steam engineering these differences are somewhat reduced, but still very striking. The gas producer is a coming factor in the power development of the world. Its purposes are to generate gas which furnishes power through gas engines. In the future producer gas and ashes will be the only products from the fuel. In producers, low-grade coals and lignites have been burned successfully, which could not be burned under ordinary boilers. In testing a large number of coals from many places, some important results have been developed which would tend toward conserving the coal supply. The most important of these shows that the vast brown and black lignite deposits are available for use in the gas-producer. It has been demonstrated that brown lignite will produce in some cases more than four times the power when used in the gas-producer than when burned under a boiler.

A force of specially trained experts have been for some time making a careful study of coals which contain too much ash or sulphur to be available for ordinary commercial purposes, and which in coal-mining are left under ground. These investigations have resulted in proving that these dirty coals can be greatly

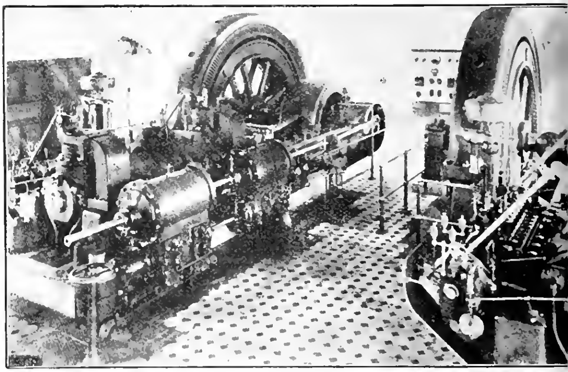


Plate No. 2.

improved by washing, or can be used advantageously as they are, in a gas producer. At the present time gas-producer tests are being made on "bone" coal containing from thirty per cent. of ash upward.

So far no trouble has been experienced in running producer plants on this material.

Some of the old dumps are available as well as the "bone," which is in place in the mines, and should the experiments now being conducted at the fuel testing plants be entirely successful, there should be a market for this material.

It has not been the aim of the testing plant to determine the lowest amounts of coal that could produce a given power, or to determine the highest possible efficiency of the producer plant installed. The work of the plant was restricted to the determination of the possibilities of utilizing the bituminous coals, lignites, and other fuels for the production of power. In spite of the fact that no series or runs have been made on any one coal for obtaining the best possible results, it is nevertheless gratifying to report that official records have been made as low as 0.95 pounds of dry coal per hour burned in the producer per electrical horse-power developed at the switchboard; or 0.80 pounds of dry coal per hour burned in the producer, per brake horse-

power per hour, on the basis of an efficiency of 85 per cent. for generator and belt.

About a year ago several manufacturers were asked the following question: "What are the serious difficulties in the way of more rapid development of gas producers and gas engines as a means of development of power?" The summary of the replies would indicate the difficulties to be about as follows:

1. The fact that the gas engine is not yet as reliable as the steam engine.

2. The lack of engineers who know how to run producer gas power plants.

3. The large number of unsuccessful and only partially successful installations made during the experimental period of this development.

4. The lack of proper design and construction of producer gas engines.

5. The lack of knowledge and confidence on the part of the public.

6. The fact that the heating of factory buildings must be provided for by a heating plant separate from the producer plant.

7. The lack of complete knowledge as to how successfully the different fuels in the different localities of the countries can be used in gas engines.

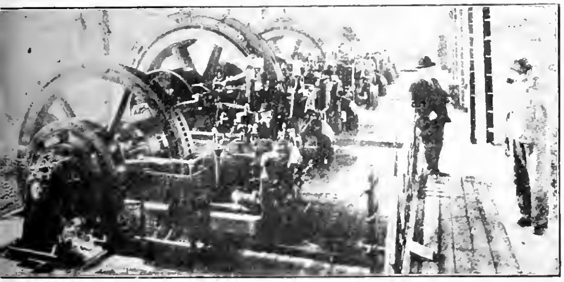


Plate No. 3.

8. The excess cost of gas engine—gas producer power plants over the cost of steam power plauts .

About one hundred and fifty gas producer plants, ranging in size from 20 to 6,000 horse-power, are now in operation in the United States.

Of the total number of installations in the United States it is interesting to note, that about two-thirds are suction plants, which operate on anthracite coal, charcoal being used in a few cases. Bituminous coal is used in approximately one-third of the installations, but this one-third of the number of plants probably covers in the neighbourhood of 65 per cent. to 75 per cent. of the aggregate horse-power rating. I have given you the troubles that beset the manufacturers of producer plants, and will now try and give you as far as possible the exact situation as deduced from the surmises of the operators and owners of fourteen different plants picked out at random.

1. The plants as a whole are giving remarkable satisfaction considering the very brief period of development that has passed since the introduction of this type of power.

2. The most serious difficulty seems to arise from the lack of competent operators to run the plants rather than from inherent troubles with the plants themselves.

The situation as a whole at the present time seems to the cost of installation, operation and maintenance, to be very favourable for the producer gas plant, both as and as to reliability. With the additional impetus given by the successful demonstration at the government fuel testing plant, that the bituminous coals, lignites and peats can be utilized with great economy of power within the next few years the use of the producer gas plant may surpass even the most sanguine hopes of the manufacturers.

So far I have taken up the question of plants as far as the engine, and will now try and give a few interesting and modern ideas in regard to the most important problems connected with the gas engine.

There are a vast number of different makes of gas engines, but I shall only talk about the German engines, as they seem to be making the greatest headway.

The merit of having entered upon the new path which the construction of gas engines has followed for five or six years undoubtedly belongs to the Germans. The old makers of gas engines in Germany took the initiative of departing from old methods. In a short time their processes were themselves improved and perfected by the makers of steam engines, long accustomed to circumvent or overcome practical difficulties in the construction of large engines. With the exception of large gas engines tending toward a single type, it may be said that they all have manifest tendencies to resemble the modern steam engine from the point of view of form of valve gear.

Having regard to the fact that valves are the common means of distribution, that they are operated by a side shaft, and that large engines are now working double-acting, it is natural and logical that the explosion machine should borrow from the steam engine the design and method with which it has been equipped in its long and victorious career. Plate I.

The introduction and growth of suction gas producers, and the utilization of different fuels, have led to the creation of different designs for the construction of engines. Different principles have thus been modified in their applications, such as the regulation, the compression, the cooling, and the ignition.

Without dwelling upon the diffrent stages of their transformation, I will briefly show in what way modern methods differ from old methods.

New Principles of Regulation.

(1) The "hit-and-miss" system of regulation has been completely abandoned, as after a stroke with no charge the following explosion is more powerful in certain cases and weaker in others.

(2) That too violent explosions, injurious to the life of the working parts, are often produced.

(3) That the intermittence of the explosions produces cyclic variations or irregularities in the revolutions of the fly-wheel regarded individually, and that these irregularities are incompatible with the working conditions of dynamos for lighting, etc.

(4) That to overcome these difficulties it is necessary to use extra heavy fly-wheels, which constitute an additional load on the engine and cause a reduction of mechanical efficiency.

They have now a variable balanced admission valve which is run by eccentrics and "roller-path" levers, thus securing a more silent and gentle action relative to the size and weight of the parts to be actuated.

From experiments it has been calculated that the

quantity of circulation water required for the different parts is as follows:

Per B.H.P. per hr. for Engines of 200 to 1,000 H.P.	Gallons.
Cylinders, Cylinder ends, and stuffing boxes	4 to $5\frac{1}{4}$
Pistons, piston-rods	$1\frac{3}{4}$ to $2\frac{3}{4}$
Valve-boxes and seats, and exhaust valves	$\frac{7}{8}$ to $1\frac{3}{4}$
or a total of	$6\frac{5}{8}$ to $9\frac{3}{4}$

An engine of 1,000 h.p. of the two-cylinder, double-acting type, would therefore require about 8,900 galls. of cooling water per hour.

Magneto Spark Ignition.

The use of the magnets producing a spark on the break of the circuit has done away with all the old methods of ignition, such as the incandescent tube, the spark produced by batteries and accumulators, by dynamos, etc.

The double-acting engines are provided with two distinct ignitions for each piston face, the one placed near the inlet valve, at the top, and the other near the bottom, near the exhaust valves.

The action in a gas engine of German design is as follows:

1. The ignition of the mixture and the development of the motive pressure take place after the introduction of the charge and its compression quite close to the back dead-centre of the piston.

2. The expansion of the ignited mixture and the transmission of the power to the crank-shaft take place during the forward motion of the piston.

3. When the piston has reached its front dead-centre, the expulsion of the products of combustion and the admission of the new mixture takes place.

4. During the backwards stroke of the piston the latter produces the compression of the explosive mixture.

The working piston does not effect the suction of the mixture; the latter is delivered to the cylinder by pumps, and the new charge itself expels the products of combustion which it afterwards replaces.

The introduction of the new mixture therefore takes place in the following way:

1. It distributes itself at once over the whole section of the cylinder and thus drives out uniformly the old mixture.

A stratum of neutral gas interposes itself between the new mixture and the hot residuum of the preceding explosion, preventing the contact of the two mixtures and premature ignition of the new charge.

The regulation of the engine is obtained by two means:

1. By retarding the delivery of the gas-pump. This retardation is obtained by operating the slide valve of the pump by a link operated by two different eccentrics. The link is shifted by the action of the governor, which raises and lowers it. This mode of regulation requires the use of a very heavy governor.

2. By establishing a communication between the delivery and suction of the gas-pump. This passage is provided with a throttle valve actuated by the governor. When this valve is partly open, a varying quantity of gas repasses, during the suction period and during the first period of the return of the piston from the delivery passage to the suction chamber. The gas column recedes into the passage near the inlet-valve, and is replaced by air. On opening the inlet-valve a quantity so much richer in air and weaker in gas enters the cylinder, according to the opening of the valve. The regulation, as in the first case, is effected by means of a link.

The Koerting Co., of Germany, put in a plant for the Lackawana Iron and Steel Co., of Buffalo, consisting of ten coupled dynamos and two-cylinder engines of 1,000 h.p. each, and sixteen engines of the same power, which drive from their crank-shaft blowing engines for their blast furnaces. Some important installations have also been made for the utilization of lignite, which is very abundant in many parts of Europe and America. This lignite is treated by special producers supplying gas under pressure. Plate No. 2 is a view of two 2-cycle double-acting of 300 h.p., fed with gas produced from lignite.

Plate No. 3 represents an electric station installed in Germany and driven by coke-oven gas. It consists of three Otto-cycle engines, single-acting, of which three of 300 h.p. are of the twin-type with fly-wheel dynamo, and one is a single cylinder of 125 h.p. with dynamo on the crank shaft.

Plate No. 4 shows a 3,000 h.p. twin-tandem engine of German build.

Plate No. 5 shows the governor mechanism used on plate No. 4.

In closing his paper, Mr. Johnson added the remark that the difference between the lignite producer and the ordinary producer in which you get gas from coal, is that there is no "vaporizer" in the lignite producer.

Discussion on the Paper.

At the conclusion of Mr. Johnson's paper the chairman, in opening the discussion, said:

"Gentlemen, you have heard a rather interesting paper on a subject which to-day seems to be taking to itself a new lease of life. The producer gas plants, some years ago, were, I think, very popular throughout England. When I was over there five years ago, I found that they were being introduced into a number of large manufacturing plants throughout the country, and it did not seem to matter what plant you visited, everyone was full of enthusiasm, and trying to sound the merits of this gas producer system of supplying power. Since then, I dare say some of you, the same as myself, have heard reports rather to the contrary from England. When we mention gas producer plants for producing power to people who come over from England, they say that the thing has 'petered out'; 'it is an exploded idea, there is nothing in it.' But it seems to me that to-day it is coming to the front again.

"Some of the mechanical defects in connection with the application of this system have been got over by engineers, and from the figures shown in this paper, in regard to fuel economy in the production of power, I should say that there is a great field for engineers to-day in settling this question.

"We generally reckon that with our modern triple-expansion engines, $1\frac{1}{2}$ pounds of coal per horse power hour is about as good service as you can get. In fact, it was only a short time ago that $1\frac{1}{2}$ pounds of coal per indicated horse power per hour was scoffed at by a large number of not only marine sea-going engineers, but by owners of steamships, whose pockets are, of course, touched very quickly by any increase in the cost of fuel on steamers. The reason I mention marine work is because of the limited capacity of vessels for carrying a large quantity of fuel. The engines used in our steamships to-day are increasing in power, and in consequence the quantity of fuel which it is necessary to carry in our liners is becoming larger, and anything which tends to lessen the quantity of fuel necessary for the production of power will be felt quicker by our

marine service than any other. I think it is particularly apropos to-night to refer to the advices published in our newspapers during the past few days, that the British Admiralty, one of the most conservative institutions, possibly in the world, is to-day allowing a firm of gas producers to experiment on an old battleship with gas power for propulsion. It seems to me that the spirit of "get-aheadiveness," if I might term it, which has so characterized the mechanical world during the last few years, has touched our Admiralty, and that body is to-day, in a very small way perhaps, open to experiments with a new kind of fuel. We can quite understand the necessity for that, and, in fact, engineers have for years recognized it, but they have not, until quite recently at any rate, been able to show the Admiralty the necessity for supplying an alternative means of producing power on board their ships. It is not surprising that they will be conservative, because if the door were opened too wide to experiments it might cost the country a great deal more in experimenitng than in actual production of power, and we know that if there is a victim on which experiments are tried by engineers, it is the government of any country, and consequently we cannot wonder at the conservatism of the Admiralty. The fact that they are experimenting with gas engines would go to show that there must be something in them or they would not allow the experiments to be carried on. When we get figures such as we have in this paper, showing that the fuel consumption for a certain given horse-power is reduced 50 per cent., I do not wonder at the most conservative men in the world opening their eyes, and opening their doors to experiments.

I must say that I am not very familiar with the gas engine myself, but I can remember, as far back as 1871 or 1872, watching the Otto gas engines running in different plants in the Old Country, and I remember standing for hours watching with admiration one of those little Otto engines—they were very small—watching the way they did their work in an exhibtiion which was held in London. It seems to me the Otto people deserve a great deal of credit for having stuck to the subject and experimented with it until they have brought such perfection to the gas engine which we see in these large plants to-day.

"There is one little point in connection with this paper which struck me. The writer would give us to understand that the cost of boiler feed water can be eliminated from the cost of operating the gas plant. I do not think we can afford to eliminate the use of water when we read a little further on of the quantity of cooling water which it takes for circulating around the jackets of the cylinders, and so on, for keeping them cool, which just about counterbalances the cost of feed water in a steam plant."

Mr. Johnson:—In the gas plant you can use the water over again, which you cannot do in a steam engine.

The Chairman:—What about your condensers in a steam plant; they enable you to use the water over again?

Mr. Johnson:—Yes, to a certain extent, but in condensing steam you lose quite a lot of water, but in the gas plant you can use all your water over again with the exception of a very small quantity which is lost in circulation, and the water is kept continually circulating from the tank to the water jackets around the engine.

Mr. Camp:—Then it would be necesary to have a very large reservoir in connection with your plant?

Mr. Johnson:—Yes, there is a very large reservoir connected with the plant. Some plants use water direct from the water main, but of course that is not a fault of the engines themselves, but the people running them.

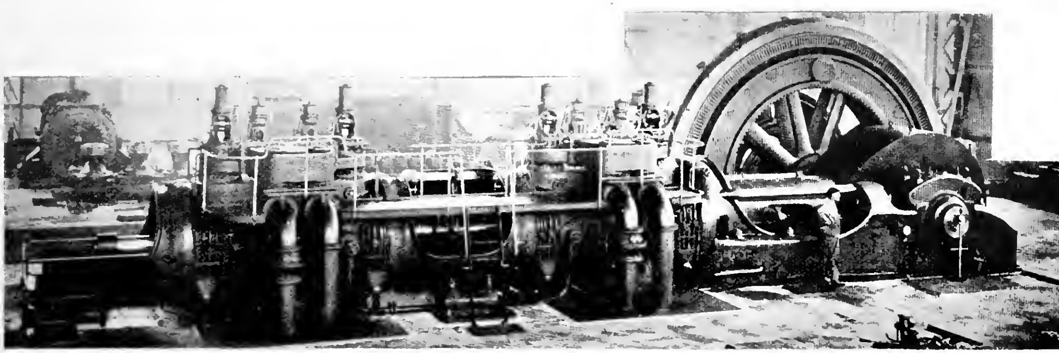


Plate No. 4.

The Chairman:—I should like to remind the writer of this paper of one thing in connection with the amount of water wasted by condensation, and the fact that you do get back some amount of water from the cylinders of condensing steam engines. I think the amount of water which is returnable—we will not say to the boiler—but the amount of water which is returnable, would average about the same as in the gas engine. The only loss I know of in the condensing of water in a steam engine is from leakages from glands and from leaky joints, but there is quite the same danger of having leakages—although there are not quite so many connections—with the gas producer plant. I think, however, the difference between the two is so insignificant that it hardly amounts to anything.

Mr. Maver:—I have noticed the difference in cost of fuel consumed in the gas plant, as compared with the steam plant, but nothing appears to be said as to the cost of installation of the gas producer plant, as compared with that of the steam plant.

Mr. Johnson:—Of course the cost of installation of a certain horse power gas producer is a little in excess of the cost of a similar horse power steam plant. In the case of the smaller capacity plants it is about thirty per cent., I should say, roughly speaking. With a larger plant, for instance a 6,000 horse-power plant, it would

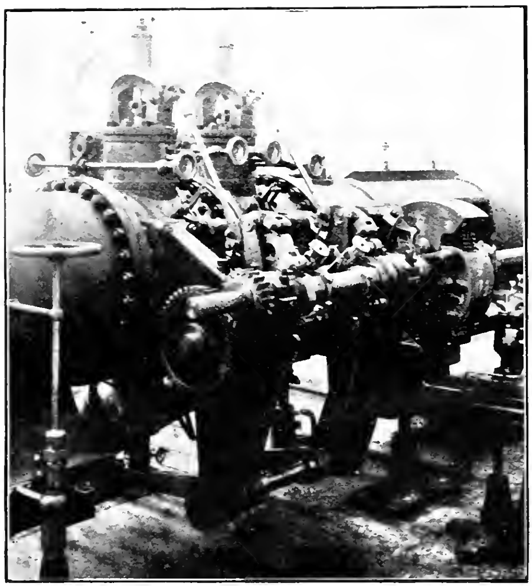
run up to probably from 35 to 38 per cent. in excess of the steam plant.

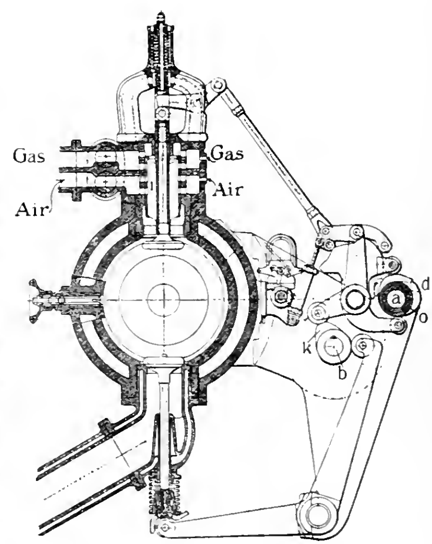
Mr. Underwood:—Could the gas engine be used in units in the same manner as the electric motors? That is, is it possible to use the gas engine in shops to replace the belt-driven and overhead shaft drive, by direct drive on the machine, or group of machines?

Mr. Johnson:—In small shops, say up to 150 horse-power, you could use a direct drive from the engine, but in the case of higher powers than that, the power is generally transformed into electricity, and the shop run by that.

The Chairman:—I think, perhaps, Mr. Underwood's question was hardly understood. The question was this, as to whether this gas engine could be used in small units, and by direct drive, on the different small machines, in a somewhat similar manner as the electric save in the end. This is just an idea, and while I am not able to discuss it, I would like someone to do so, and bring out the point. Would it not be possible to replace the electric motor now used on each machine, with a gas engine to drive an individual machine of say large capacity, or a group of small machines? We would get that fifty per cent. efficiency, and as these gas engines are very small, they would not take up very much shop room. There would be no shafting, no cost of electric generator or electric motors, and I think the cost of operation of the plant would be very low per horse power as compared with the motor-driven plant per horse power.

Mr. Shaw:—In the plan suggested by Mr. Underwood it would be necessary to pipe the gas, and the cooling water from some central plant to the engines, which would be very expensive. The gas engines would then take up valuable floor space, while on the other





Gas-Engine (Dingler).

Plate No. 5.

motor? but, I should say that the gas engine should be used as a prime motor, and the power distributed by means of electricity to the different machines. I do not think it would pay, from what I have seen of gas engines, and while my experience has not been very extensive with this class of engine, from what I have seen, I would think that it would make an enormously expensive installation to put as many small units of gas engines around a shop as we are able to do with electric motors, as besides the additional space required, there would be all the piping to carry the water to and from the cooling jacket as well as the gas pipes.

Mr. Underwood:—My idea was that if you are going to save fifty per cent. in the cost of power production by the use of gas instead of steam, then you can also make a reduction in the saving over electric appliances, so that if you can operate your machine direct from the gas engine, you save fifty per cent. in fuel, and the cost of electric appliances, and even though the cost of installing the gas engines is a little higher, you might

hand, the electric motor can be placed overhead on the walls, and the cost of electric wiring is very small.

Mr. Johnson:—In regard to the use of small engines, as suggested by Mr. Underwood, that has never been done, and I do not think it ever will; that is, having the machine direct driven by the engine, because the man looking after the machine cannot look after the gas engine at the same time. If he wanted slower speed, or to stop his machine, he would have to stop his engine, and it stops so quickly that it would injure the machine.

The Chairman:—I think from what I have heard, and from what I have seen a gas producer engine do, that the only way it could be satisfactorily operated would be as a prime motor in a power house. I do not think the author of this paper, or any advocate of gas engines, would suggest to distribute gas engines over a plant to run individual machines. In the first place, every gas engine has to be treated alike. They must have gas, and consequently a gas pipe. They must have

water to cool the cylinders, and to convey this water they must have water pipes, and the cost of installation would be too much.

From what I can see, the gas engine is certainly worthy of some study. The system of producing gas for operating these engines from coal which is not suitable for use in ordinary boilers will be a means of conserving our coal supplies, and when we can make use of such products as this paper mentions, which to-day are practically waste products, it is worthy of following up. I am quite sure that if it effects the economy claimed for it, the engineers who have taken the matter in hand, to say nothing of those German engineers who have stuck to it until now, will overcome the little defects the system now has.

Leamington Light Company Changes Hands.

The Leamington Electric Light Co., of Leamington, Ont., recently passed out of the hands of W. Stares and his partners, having been purcahsed by a Detroit syndicate. This plant was established in Leamington about twenty years ago by Mr. Stares and others who had just previously attended the Toronto Exhibition, and been greatly attracted by the lighting system which supplied illumination for the grounds. They made arrangements to purchase the machinery which supplied this light, and it was shipped to them at the close of the exhibition. One of the machines purchased at that time is still in use. The new stockholders of the company are Messrs. Robert B. Stewart, J. D. Oxtonby, G. D. Hayes, G. B. Northrup and Mrs. Isabella Northrup, Detroit. Mr. Northrup has been elected president and Mr. Hayes secretary-treasurer of the new company. The company intend to increase the plant immediately and will soon be in a position to give an all-night service.

A Marked Improvement in Business.

Mr. Walter H. Whiteside, president of Allis-Chalmers Company, recently made the following statement in an interview: "There is a marked improvement in general business. Within the last ninety days the bookings of machinery orders have increased from thirty per cent. to fifty per cent. of normal. New enquiries received are constantly increasing in number and volume. They are of a much more substantial character than at any time since the depression began. Their general tone denoted extensive plans in contemplation and for early development; the question of promp shipment being already regarded as an important consideration.

"The immediate requirements for a larger volume of new machinery for necessary extensions and improvements to existing plants are greater than for four years. This is because, with many operating companies, purchases which under ordinary circumstances would have been made a year or eighteen months ago, were put off, due to the monetary and other conditions, until to-day the factor of safety in these plants is becoming a serious matter and new equipment must be added.

"Unlike previous depressions, following which collections for comparatively long periods continued very unsatisfactory, there was a substantial improvement within a short time after the recent flurry, and at the present time collections are exceptionally good.

"While some difficulty may still be experienced in the way of financing entirely new undertakings, yet the financial condition of the relatively small buyer is on a sound basis and credits are about normal. In fact, the improvement in new orders placed, is from the smaller class of purchasers, who are, commercially, an important factor. Of course, this class of business is widely diffused, but in the aggregate it is greatly stimulating improved trade conditions. The business outlook is distinctly encouraging."

Mr. J. A. Milne, general manager of Allis-Chalmers-Bullock, Limited, in an interview stated that the same conditions prevail with the Canadian company. Business has already improved, and he expects that the progress will be continuous and substantial.

Loan Building Lighted With Nernst Lamps.

The accompanying illustration shows a view of the interior of the' B. C. Permanent Loan & Savings Company's new home on Pender street, Vancouver. This building, though small, is most elaborately finished and fitted up, the general plan being along the lines of the Bank of England head office building. The beautiful art glass dome in the centre is the admiration of all who have seen it. Part of this is shown in the

Interior of B.C. Permanent Loan & Savings Company, Showing Nernst Lamps.

view, while surrounding it can be seen several of the famous "Nernst" lamps with which the building is lighted. These lamps are finished in Verde antique copper and are fitted with holophane bowls, which produce a very brilliant effect. There are ten lamps in all, developing a total of 2,250 candle power, which gives a daylight effect through the entire office. The view was taken from the president's office, which is upstairs, at the rear.

The Westinghouse Electric & Manufacturing Co. have obtained a preliminary injunction in their suit to restrain infringement of their claims 1 and 30 United States letters patent No. 469,809, to Wm. Stanley, Jr., for improvements in systems of electrical distribution. The particular patent of which infringement is alleged covers "combinations, including a convertor in which the length of wire in the primary coil is substantially the same as would result from following the so-called 'Stanley rule'." An opportunity to appeal for a proper review of the issue is afforded by an order that the preliminary injunction shall be suspended on November 15th, 1908.

The town of Melville, Sask., is negotiating with the Grand Trunk Pacific Railway Company to furnish electricity for lighting purposes.

TELEHONE TOPICS

Essex County to the Front.

While Ontario as a province has been making rapid strides in rural telephone development, the County of Essex has been keeping to the front, and to-day can boast that it is the leader in so far as municipal telephone systems are concerned, being the only county in the entire province that has a municipal telephone system in operation, says the Windsor Record. The first system of this kind was installed by the township of Rochester, and to-day they have completed telephones on all the leading roads in the township and have connected up 175 subscribers with excellent equipment and at a very attractive rate. Following the initiative of Rochester township, North Gosfield council took the matter up, and they have their system almost completed throughout the township and will start with over 100 subscribers. Almost at the same time the township of Maidstone commenced their system, and expect to be ready to operate it in a very few days with a list of 75 subscribers. This will make three complete municipal systems in this county, connecting over 300 subscribers, thus giving the farmers living in these townships direct connection with their marketing towns, and also with the other cities and towns throughout the province.

The Speed of American Telephone Practice.

In an interesting article in the London Times, Mr. Herbert Laws Webb, the well known English expert, discusses telephone progress in America. Among other things he says: "The secret of the extensive use of the telephone in America is that telephony in that country is a highly specialized technical business, whereas in Europe it has been the sport of politics, and has generally been relegated to the position of a minor branch of the government department responsible for posts and telegraphs, a position in which enterprise, scientific organization and continuous study of the requirements of the public are not to be found.

"The essential features of American telephone practice, the factors which bring about such great results, are uniformity of equipment, both of exchanges and subscribers' stations, constant improvement in technical methods, and minute and unceasing study of the traffic, of the operating methods, and of the requirements of the system.

"The most interesting feature of American telephone administration, the one that is responsible for a city service of thirty seconds, a suburban service of very little more, and a long distance service of a few minutes, is the traffic department, which constantly watches the traffic, tests and measures the traffic, analyzes it, and studies it from every point of view.

"To do all this work naturally demands a highly expert organization. The volume of telephonic traffic is prodigious, and the complexity of the system, with its hundreds of thousands of units gathered into one vast organism, is very great. To-day there are city telephonic systems which handle well over a million calls daily—four times the number of telegrams which circulate daily in the entire United Kingdom. Every American telephone company has its traffic superintendent, who has entire charge of the operating department. His staff consists, roughly speaking, of two divisions—the operating force, which conducts the traffic, and the supervising and engineering force, which tests and measures the traffic, compiles statistics, investigates methods of working, suggests improvements in methods or in apparatus, and states the requirements of the traffic department when new exchanges or extensions are contemplated.

"As to economy resulting from improved efficiency, reference may here be made to a new method of operating suburban calls which was being brought into use in New York. The suburban call in America is already amazingly quick. Tests in this connection made in New York last month showed that in no case, day, night, or Sunday, was the answer delayed longer than ninety seconds. To the reader this will seem incredible, but it is a fact. A similar test made the other evening, at the very slackest time of day, to a place less than forty miles from London, took just half an hour, and the man at the other end had been trying for an even longer period to get through to London. But the new method of working suburban calls devised by the traffic department of the telephone company in New York results in making the suburban call within a few seconds as quick as a local call."

The French naval lieutenants, Colon, Jeance and Mercier, inventors of a wireless telephone apparatus, have achieved remarkable success with their new instrument, communicating with the wireless station at Rad Ze Seine, department of Finistere, a distance of about 310 miles. The transmitted words were somewhat faint, but could be plainly distinguished, and the officers are confident that they can make great improvements in the apparatus, which has been the result of only four months' experimentation. Conversation has been exchanged by the apparatus up to 600 or 700 miles. Lieut. Colon is now superintending the installation of an improved and more powerful plant in an endeavour to make possible the transmission of despatches between Paris and New York.

The Independent Convention.

President J. F. Demers, of the Canadian Independent Telephone Association, at its recent convention delivered an interesting address. He recalled the contest some of the independents had carried on with the C.P.R. in order to get Independent telephones into the offices of that corporation. The contest had resulted successfully for the Independents, and since then a great development of the Independent business had been effected.

The officers of the association were all re-elected with the exception that Mr. Alpheus Hoover, ex-president, replaces Mr. J. Dyke, of Fort William, on the executive. A resolution was adopted by the association favouring the formation of branch associations in the various sections of Canada. The president was directed to nominate a delegation to appear before the Ontario Government in support of the resolution adopted at the last convention regarding exclusive franchises in Ontario, and operating companies are to be requested to urge their local members to be present and support the delegation.

The following resolution was also adopted:—

Whereas the Bell Company is proposing long distance connections to local Independent telephone companies in various parts of Canada, and in the opinion of this convention such are bound to injure the cause as a whole, this association frowns upon and denounces any such foolish connection as injurious to the people as a whole.

Telephone Wires for High Speed Telegraphy.

An invention by means of which it is said that 40,000 words per hour can be sent over a telephone service, is reported by U. S. Consul Brittain at Prague, to have been perfected by a Hungarian. The machine consists of three parts, a perforator, transmitter and receiver. The first may be worked by a typewriter, while the other two are automatic, working through the agencies of electricity and photography, and the instrument may be connected by an ordinary telephone line.

Through operating the keys of the perforator the operator writes messages upon a long paper ribbon. By touching the keys a series of holes are punched in the ribbon, each set of holes representing a letter. After taking the ribbon from the perforator, the inventor places it in a small cylinder in the transmitter, and a touch of the switch sets the cylinder revolving and the ribbon with it. Before the ribbon has completely passed through the transmitter, a second broader strip of sensitized paper issues from the receiver, and upon it is written in plain legible characters the actual message which the inventor or operator has written on the typewriter. It is claimed that messages may be thus transmited hundreds of miles, as well as short distances. It is said the inventor has discovered a means of harnessing light to electricity, by which a tiny spot of light hundreds of miles away is cotnrolled as readily as when close by.

New Telephone Companies.

Among recent concerns to secure charters are the following: Heckston Rural Telephone Company, Ltd., Heckston, Ont., incorporated, capital $5,000; incorporators, A. J. Cumming, W. Sloan, J. W. Shaver, W. Robinson, all of South Gower township, and others. Bolton Telephone Company, Ltd., incorporated, capital $20,000; incorporators, Robert Smith, A. A. McFall, F. N. Leavens, H. A. Rutherford and W. A. Caldwell, all of Bolton, Ont. Farmers' Long Distance Telephone Company, Ltd., Blenheim, Ont., capital $40,000; incorporators, N. Watson, M. H. Newcombe, J. Whittington ,A. Huffman and D. McCoig, all of Harwich township, Ont. Hawthorne Hill Rural Telephone Company, Ltd., Palmerston, Ont., incorporated, capital, $10,000; incorporators, W. H. Mallett, Wallace township, and J. Goodwin, A. Derroch, G. G. Wilkin, W. Murdock and J. D. Cooper, all of Minto township.

Another telephone line, making the third connecting Manitoba and the United States, will shortly be in use. The connection will meet two American lines at Hannah, N.D.

The Manitoba Telephone Commission has opened long distance telephone offices at Pipestone, Sinclair and Reston. Others will be opened shortly at Dugold, Lorette, St. Anne, Steinbach, Niverville, Carey, St. Pierre, St. Malo, Somerset, Altamont, Swan Lake, Mariapolis, Greenway, Newdale, Strathclair, Kelloe and Solsgirth.

Central and Exchange Notes.

The Dominion Securities Corporation have purchased $12,000 four per cent. 20-year telephone bonds of Strathcona.

The contract for constructing the Pipestone, Man., municipal telephone system has been secured by John Reid.

The Hamilton Township Rural Telephone Company are planning the extension of their lines into Northumberland county.

The contract for the construction of the Argyle municipal telephone system, Baldur, Man , has been awarded to Playfair Brothers.

The contract for the construction and installation of a telephone system throughout the municipality of Morton has been let to Elliot & Welch, of Boissevain, Man.

It is stated that the Manitoba Government will immediately extend the telephone line from the terminus at Sinclair to the border to connect width the Saskatchewan system.

The Woodstock city council have received a communication from the Burgessville Telephone Company, Ltd., making application to bring their line into the city. It is stated that this extension would connect about 1,100 subscribers in the southern part of the county.

Net earnings for July of the associated Bell telephone operating companies ,exclusive of the American Telephone and Telegraph Company's long distance lines, were $2,839,200, compared with $2,241,200 for July, 1907. For seven months to July 31st the comparative net earnings were as follows: 1908, $18,241,900; 1907, $16,560,800.

The contract for the construction of the line from Lumsden to Saskatoon has been awarded to J. S. Bartleman, of Regina, at $79.75 per pole mile. The other tenders received were: Saskatchewan Telephone Co., Moose Jaw, $82.50 per mile; V. G. O'Brien & Co., Portage la Prairie, $120; Rural Construction Co., Regina, $98.75. The contract for the construction of the line from Regina to Antler has been awarded to the Saskatchewan Telephone Co., Moose Jaw, at $79.50 per pole mile.

A municipal contract has been let in Wallace, Man., for building 100 miles of telephone line, which it is hoped will be completed this year. Woodsworth municipality also has 100 miles under contract. Brandon has added thirteen miles to its line, and so has the Roseland district. Hayfield has added thirty miles, Portage la Prairie has added fifty miles, and Laverham, Snowflake and Cypress River are all making active progress. A new line has also been commenced between Gilbert Plains and Ashville.

A number of changes will be introduced in the Winnipeg telephone exchange before the end of the year. Fort Rouge numbers will be prefaced by the word "South," and other city numbers by the word "Main." In addition to the new big switch board, two additional boards will be necessary for connection between the exchanges. The subterranean conduits for Fort Rouge are now complete and the cables have been threaded. The aerial construction is also practically completed and it was expected that the exchange would be ready for service early in the present month.

Geo. Collison will receive a franchise and a bonus towards erecting a new electric light plant at Killarney, Man.

Electricity's Relation to the Life and Fire Hazard

Difficulties Met With by Electrical Inspectors. Various Electric Causes of Fire. The Dangerous Handy Man.*

It was seventeen years ago that the first underground wires of the Toronto Incandescent Light Company were put down, which ushered in the electric light and power service which has grown to what it is now. From that time until to-day electric wiring has been steadily passing through a series of evolutions. When incandescent wiring was first introduced here, porcelain tubes, insulators and cleats were not used. Inside wiring was supported on wooden cleats and passed through floors and joists without any kind of insulation other than the covering on the wire. There are at the present time in Toronto a few buildings where some of this class of wiring is to be found but not very many. In the old days cut-offs were made of wood with open link fuses and worse still were coated with paraffine, such a device as this now would be looked upon as a fire brand. This did not last long as the weak features of it were soon detected. The cut-off is one of the most important fittings in connection with electric wiring and a few remarks about it will not be out of place. While calculated to protect, it is probably one of the most prolific of the causes of electric fires. In most cases this is owing to carelessness blended with ignorance. It is rarely that properly selected and properly located cutouts ever cause any loss. The primary use of a fuse is the protection of the wire and fittings against overload or short circuiting. It simply is the making of a weak point in the circuit or wire which will melt or fuse should any abnormal current pass over it. It is not even necessary for inflammable material to be actually or nearly in contact with blowing fuses as it is quite a common thing for small pieces of molten metal to drop or fly into nearby rubbish or other inflammable material. Particles of molten metal have gone several feet from a "blown" fuse and been known to communicate fire. It is therefore always advisable to have old style open cut-outs replaced by modern enclosed fuses.

As the potential or pressure of different systems varies, and as cut-outs are used on circuits all the way from 110 volts to 2,500 and even higher, it is one of the most important requirements that the cut-outs be selected and installed on the circuits for which they are designed. For instance it is a serious danger to have cutouts of say 110 volts used on circuits of 500 volts, although no harm can result from reversing this order and using 500 volt cut-outs on 110 volt circuits. In fact such would be an advantage if anything. The reason for this is that when a gap is suddenly created in a circuit, such as would be caused by the blowing of a fuse or from various other causes, the current has a tendency to continue to flow across the gap thus created, which is known technically as "arcing." These arcs produce extreme heat and cause the points of arcing to melt rapidly. The length of this arc or the gap across which the current continues to flow increases with the pressure or voltage so that what is known as the "break distance" between "cut-out" and switch terminals is increased with the voltage. On all ordinary incandescent lighting circuits from 110 to 250 volts, the Edison plug cut-out is largely used, more especially in the cities. The fuse in this cut-out is enclosed in a round porcelain plug which is provided with a threaded brass shell which screws into a female thread in the cut-out. The end of this plug has a small brass button which when the plug is screwed down comes in contact with a metal plate also in the cut-out. The female thread on the cut-out is connected to one side of the line and the metal plate to the other. Inside this plug is a strip of fuse wire varying in thickness according to the amount of current it is designed for. This strip of fuse wire is soldered between the brass button and the male thread so that when the plug is screwed into the cut-out the current passes through the strip of fuse wire. The top of this plug is covered with a disc of clear mica held in place by a brass ring so that the fuse can be readily seen, thus indicating whether it is in good condition or "blown." This form of cut-out is intended for circuits up to 125 volts pressure and not used on circuits of over 30 amperes. For small circuits of ten or twelve lights on 125 volt systems it is a very satisfactory device but on all other classes of work it is advisable to use what is known as "enclosed fuses" with metal tips at each end, which are attached to the terminals of the cut-out. Between these metal tips inside this fibre cartridge is the fuse wire. The space inside the shell is filled with a white powder, this powder is some sort of non-inflammable material, such as plaster of paris or French chalk. This powder acts as an extinguisher and prevents any arcing or burning of the fibre covering, otherwise, a hot arc or the blowing of a large fuse would tend to blow a hole in the fibre and drop burning or molten matter in dangerous places.

Enclosed Fuses the Safest.

Enclosed fuses have come to be regarded as the very best and safest fuses on the market, and are used on all circuits up to nearly every size, except where circuit breakers are required. Circuit breakers are an electro mechanical device for opening heavy circuits where the ordinary fuse wire would be very objectionable. They are used on all circuits from 100 amperes up and can be designed for smaller circuits if necessary. "Automatic Circuit Breakers" are generally used on direct current circuits, such as are found on trolley cars and electric light and power generators. "Automatic Oil Switches" are generally employed on alternating current apparatus. The Automatic Circuit Breaker is essentially a quick break switch with the space between the terminals located in a magnetic field. An arc is readily extinguished by the lines of force which are set up in a magnetic field. This quick break switch in connection with the circuit breaker is held in position by a trigger, which is released by the action of a solenoid or series coil through which the current of the circuit passes. The moving part of the magnetic device is weighed down by a spring at a tension in proportion to the amount of current at which it is desired that the switch should operate.

The strength of the action upon the trigger is directly in proportion to the amount of current passing through the coil. The "Automatic Oil Switch" is some-

* Extracts from a paper read before the Insurance Institute of Toronto, by H. F. Strickland, Chief Electrical Inspector at Toronto for the Canadian Fire Underwriters' Association.

what similar in principle, so far as the opening of the switch is concerned. The switch is released through the action of the current when reaching a given point, but the arc between the terminals of the switch is extinguished by the oil in which these terminals are submerged.

It is very essential that cut-outs shoud be of the most approved type and located as far as possible from contact with highly inflammable material. While the probability of fire from the approved form of cut-outs is very slight, the great danger with cut-outs is that they are frequently found to be provided with defective fuses. No matter how complete or modern the cut-out itself may be or how recently installed, it is the daily experience of the inspector to find the cartridges substituted by almost every conceivable form of metal strip which happens to be handy when the fuse has blown. These pieces of metal are often stuck across the terminals of the cut-out during an emergency where it has been the intention to replace the fuses next day, or as soon as a new fuse could be procured, but it is just as often the experience with the inspector, that it is from that moment forgotten.

In concluding the remarks in connection with cutouts, I can only add that in covering the general relation that these devices bare to fire hazard, it is apparent that the life hazard is equally subjected. There is also the danger of accident in connection with cutting. It is quite a common thing for a large fuse to blow in a worker's face, damaging, and often permanently ruining the eye sight.

The Importance of Proper Insulation.

I think the next point which I will endeavor to bring before your notice is the question of insulation. In all inside wiring, that is to say, in all buildings where electric wiring is installed, with one exception approved rubber covered wire is the most satisfactory and is demanded by the National Code. The only exception to this rule is that in extremely dry or inflammable places, such as woodworking shops, what is known as "Slow Burning Weatherproof Wire" is regarded as more satisfactory. Slow burning weatherproof wire will not soften or deteriorate in the same manner which rubber covered wire will when subjected to very high temperatures and extremely dry conditions. However, in all such places as warehouses, residences, stores and small places under ordinary conditions, rubber covered wire should always be in evidence. Still, in concealed and exposed wiring, tons of ordinary weatherproof wire is to be found throughout the province in both concealed and open wiring, which is of course, contrary to the rules of the Underwriters' Association. During the past year there has been an enormous quantity of this wire relegated to the scrap heap in this city, having been pulled out and substituted by rubber covered wire together with other modern devices and forms of construction.

One of the most important features in connection with all electrical construction of apparatus is this question of insulation. All devices, such as cleats, insulators, porcelain bushings, circular loom and similar material are calculated to maintain and provide insulation. The electric current when leaving the generator has a tendency at all times to creep to the return wire through the shortest path, so that if there is any medium such as damp wood work between two wires in any installation the current has a tendency to break across between the wires. It is very well for all electrical inspectors and others interested to notice the very first suggestion contained in the National Code, which reads, "In all electric work, conductors, however well insulated, should always be treated as bare, to the end that under no conditions, existing or likely to exist, can a ground or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to a minimum."

No matter how careful or how excellent an original installation of wiring may be, it is always subjected to mechanical injury, and owing to the circumstances, which are generally experienced in the looking after and inspecting of electric wiring, it is almost impossible to find the best of wiring jobs in good condition even within six months time. Owners of buildings in which electric wiring is installed rarely make a business of having their wiring properly handled and intrusted to competent electricians when changes are necessary. There is no trade at the present time where boys are so much tempted to tamper with existing conditions, as in electrical work. Six months experience in an electrical shop often constitutes the boy an expert electrician in his own estimation, who, with the addition of the word Company to his name, can advertise himself to the general public as anything from a repair man to an electrical engineer. I know to-day in the City of Toronto of electricians claiming to be electrical engineers and advertising the fact, who are not even tolerable wiremen, but having had a few letters from a Correspondence School are pleased to term themselves Electrical Engineers, so that Willie Jones as a boy at school with his six months' experience in monkeying with batteries shortly becomes the Jones Electric Company, and likewise Johnnie Robertson with the similar experience becomes the Robertson Electric Company and so on down the line with the Smiths, Browns and Robertsons. It might not be out of place to mention that we have in the City of Toronto electrical companies doing business under the names of Smith, Jones, Brown and Robertson and I do not wish to reflect on these estimable gentlemen in any way because they happen as a coincidence to have the above mentioned names.

It is most essential that in all electrical installations the insulation be maintained at as high a standard as possible. One weak point in a wiring system will cause a great deal of trouble, even if the balance of the system is an excellent piece of work in every respect. Instruments have been devised which will enable one to ascertain the exact condition of a wiring job, showing exactly in figures the ohms of resistance that the installation of the entire system or any part thereof offers.

Fires Caused by Electricity.

Mr. Strickland then referred seriatim, to a number of cases of fire caused by electricity, which are mentioned in the quarterly fire report of the National Board of Fire Underwriters, Number 54. In the course of these remarks he made the following comments.

Wherever metal ceilings are to be found, great care should be exercised in properly insulating the wires where they pass through the ceiling. The most approved method is to cut away a disc about two inches in diameter and bring the wires through an outlet board in the centre of the disc. The wires should be brought through the outlet board with circular loom on each wire, which should extend back above the ceiling to

the last insulator on the circuit. When electric fixtures with brass sockets are afterwards attached to the ceiling they should be provided with what is known as fixture mats or turned wooden panels. These, if properly installed, are not at all unsightly, but form a substantial support for the fixture and serve as an adequate insulation between the fixture canopy and the iron ceiling. In some cities the use of these mats is compulsory on all ceilings. They are a useful device and serve a double purpose, inasmuch as they not only separate the canopy from the ceiling but they have a tendency to keep any short circuit or canopy fire within the canopy.

The Dangers of Overloading.

The overloading of circuits is at all times a dangerous proposition. If you replace 16 candle power lamps by 140 candle power you increase the original load practically nine times. As the temperature of any conductor rises with the increase of current, this causes the wire to become dangerously red hot, therefore igniting the rubber insulation, which, when dry is very inflammable, so that the attributing of fire to this cause is quite readily understood.

The introducing of lead wire into the cut-outs is also a point involving considerable risk. This is one of the most common violations of electrical rules which an inspector comes across, and it is no common sight to see an entire panel board with all the cartridge fuses replaced by bits of lead wire. The only recourse for an inspector under such circumstances is to lodge a strong protest with the owner of the premises, so that he will hold his electricians responsible for complaints, which may be made by the electrical inspector, for violations of this description.

In surveying the various electrical installations throughout the City of Toronto during the past year or two, we have removed many hundreds of defects caused by grounding on gas pipes. There are two or three different ways that a defect of this nature can be productive of harm. The contact between the wire and the pipe may produce a flash sufficient to ignite the insulation of the wire and the flame spread along the wire till it ignites some other material. The flash in this case would probably be produced from the wire of opposite polarity being more or less grounded, so that when it touched the pipe the result would be equivalent to a short circuit. Another form of danger from a defect of this nature, a very common and a very dangerous one is the puncturing of a hole through the gas pipe by the burning of a small arc between the wire and the pipe. This small arc can often burn for hours without being noticed, until eventually the pipe is punctured, when the gas will ignite, setting up a dangerous flame which will very shortly ignite any inflammable material within reach. An insurance inspector is, therefore, always perfectly safe in strenuously objecting to wires being in contact with pipes.

All devices intended to check the flow of electric current are known as "resistances," and in proportion to the amount of resistance offered and to the amount of current thus impeded heat is produced. These resistances are generally composed of coils of high resistance wire, such as German silver, and in some cases galvanized iron. If, therefore, these coils are enclosed in an air tight box, there is no radiation and the heat becomes very intense. All resistance boxes, such as are used for starting of motors and in connection wih moving picture machines or other apparatus, should be enclosed in fireproof cases and should not be placed upon or attached directly to woodwork.

It is marvellous that we have not had more fires in Toronto than we have had from wires crossing on a bell circut. I venture to say that we have had many fires from this cause, the evidence having been destroyed, which have been charged up to spontaneous combustion and causes unknown. I have seen the result of just such accidents in Toronto during my two or three years of inspectorship. Various companies in the city controlling signal wires have their regular net work of this description throughout the city and when I first brought about an improvement in these conditions and reported to the Association that steps should be taken to protect our interests by having these circuits properly fused or otherwise modernized where they enter buildings, the idea of fire from such a cause was strongly scouted by the telegraph companies in question. However, deeds speak louder than words and the fact that these call bell wires have been known to produce fires is the best evidence that they should be properly fused where they enter buildings, and it would be always perfectly wise and justifiable for insurance inspectors, when examining risks to examine the entrances to these call bell wires and note whether they are provided with fuses.

Signal wires are often run on the same poles with high potential circuits and having been up for many years, have little or no insulation quality. In heavy storms they are very liable to become crossed, so that it is not a difficult matter to understand how necessary it is that wires should be properly protected where they enter buildings. It is true, as stated by the companies installing these wires, that the current which they use thereon is harmless, but the danger is from the stray currents with which they are liable to become charged.

The leaving of trolley poles on the wires while in the car barns, is one of the greatest dangers to be encountered with street car property. While a car is on the road it is under the care of the motorman and conductor, and any fire occurring is very quickly discovered and at the worst can only burn the car, whereas if it is in an inflammable car barn it is easy to see how far reaching the result may be.

Contractors Sometimes Delinquent.

We have often had arguments with delinquent contractors on the subject of untaped joints in wooden moulding. They will frequently leave a joint untaped and unsoldered in wooden moulding, and are indignant because we remove the capping from the moulding.

The absence of an emergency switch is rather a heavy defect. Synchronous motors draw a very heavy current when starting and until they have reached their maximum speed and synchronize or get in step with the supply current, they are a heavy load on the circuit.

In a wet place, rosettes should not be used, but a weatherproof drop should be connected direct to the wires with joints well soldered, taped and compounded. Brass sockets or fittings of any kind with bare metal connections should never be placed in damp basement locations or where subjected to corrosive vapours.

Moving picture machine fires have become quite common. The leads upon breaking, produce a flash, causing molten metal and sparks to fall on the film, which is a highly combustible material.

A fire occurred in Toronto in the moving picture theatre, which used to be located in the premises formerly occupied by Morphy the jeweller. It was a case where an electric wireman installed a few brass goose neck fixtures, fortunately outside the building in the en-

trance way. Subsequent to the inspection on the inner part of the work some of these fixtures were removed. examined and found to be properly installed. The contractor staked his reputation and future happiness on it that the balance of the work had been done in the same manner; that he did it himself and was prepared to take an oath that everything was entirely satisfactory. After the short circuit was discovered and brought to his attention he promptly blamed it on one of his wiremen, quite forgetting that he had previously assured us that he did it all himself and knew it to be thoroughly A-1 in every respect.

Troubles Caused by Grounding.

Generally speaking the word "ground" is used to imply a metallic connection between electric wires and the earth. Gas pipes, water pipes, and all metallic work such as beams, soil pipes, and metal drain pipes are considered as "grounds" and when a wire comes in contact with any such place it is known to be grounded. In one case no bushing was provided on the end of a conduit, and the wire was allowed to cut into the insulation. Such a thing as this, in Toronto now, is provided against by a very unique device known as a condulet. For the past two years we have been enforcing the use of a device of this description at all points where wires issue from a conduit. The condulet is merely a small iron bushing at the end of the pipe, with a porcelain cover provided with separate holes through which each wire may issue from the pipe.

I have known wiremen to carefully wrap layers of tape over a bare joint and neatly compound the same and have it completely buried in either wooden moulding or under the floor. When discovered by the inspector, they have stated positively that it was only temporary, and curiously enough expect us to believe it. Wires should always be fastened to proper insulating supports.

Failure to cut off unused service wires is a defect which is liable to be very prevalent in a large city and is somewhat difficult to overcome. The local electric lighting company in a large city, especially where overhead service wires are used, install many hundreds of these services and it frequently occurs that premises are vacated and unused ends of wires are left projecting through windows. To illustrate the danger I will mention a case which I came across in a building on Yonge street. A 250 volt power circuit had been run through the front walls on Yonge street, supplying power to a small motor used to drive machines. The building was then purchased by an adjoining business house and entirely remodeled, all the wires inside had been pulled out, leaving these two bare ends of the 250 volt service sticking through the brick wall. I found the wall furred out and all lathed up with new work and these bare ends left buried behind the lathing. They were twisted together just as they had been shoved out of the way by the lathers, fortunately the bare metal on the wires had not come together and short circuiting had been prevented merely through the protection of the insulation on the wire. These bare ends were liable at any time to short circuit, in fact it was inevitable that this would occur at some period, which would have ended in a fire, the extent of which it would be impossible to predict.

Grounding on a gas meter is not an uncommon trouble and is generally the result of ignorance. Gas meters are of course grounded and when any contact is made between the meter and live wires, it does not take much of an arc to burn a hole through the meter, which would be bound to ignite the gas. I saw such an occurrence myself here last winter, which unfortunately burnt the meter man considerably.

There are a great many defects which can occur in connection with an arc lamp. In one particular case the carbon holders failed to adjust themselves, causing all the current to be shunted through the shunt coil, developing heat and causing fire in the wooden ceiling. All arc lamps should be hung from an approved ceiling hanger-board. These are generally made of porcelain and should prevent fire from communicating to the ceiling. They must be used in all cases with multiple arc lamps.

As a general rule, especially in elevator motors, the current required for starting is very much higher than the maximum running load. Sometimes it is as much as double or treble, so that in all elevator motor installations the wire should be at least double the size required for ordinary stationary motors. The result of ignoring this is the creation of two apparent dangers. The melting of solder in the lug or connecting terminal would cause a higher resistance joint or sometimes a loose joint which sets up heat. This can very easily cause the molten metal to fall in combustible places. Again, the heat travelling very rapidly along the copper wire would quickly destroy the insulation, in which case the wire would come in contact with the metal of the pipe and cause a short circuit. A condulet, would probably in this case prevent the fire for some time anyway. The method heretofore employed of protecting wires where they issue from conduits was merely to screw a smooth iron bushing on the edge of the conduit, so that the wires would not lie on the sharp edge of the pipe. The superiority of the condulet is that the wires issue from the pipe through a porcelain face plate which separates them from each other.

Old and Defective Installations.

Old and defective installation is something an inspection bureau has to face in a large city, especially when the work of overhauling old installations has been taken up systematically for the first time. We have come across scores of just such installations as this during the past two years, many of which have been entirely rewired while others have been more or less overhauled to leave them in safe condition. Every installation should have a main line switch placed where readily accessible and where it would not be liable to cause more harm than good. By this I mean the main line switch should not be placed where rubbish or junk is piled up against it, and every installation should be provided with main cut-outs of the cartridge type. Wooden cut-out blocks are now practically gone forever and I do not think there is one today in the City of Toronto. During the past month in Toronto we unearthed an installation where ordinary bell wire was used and the wires were not even insulated from one another.

It is important to call attention to the fact that no matter how good cut-outs may be they should not be close to inflammable material. All fuses, good, bad or indifferent, should be located where under no conditions they can communicate fire.

Flexible cord should not be permitted except where it hangs freely in the air, and if it has to be long enough to carry around it should be what is known as "reinforced."

The conclusion to be deducted from accounts of au-

thenticated fires is that electrical installations offer a fire hazard under almost all conditions, and no matter how good the installation may be, the handy man is a menace. There is no doubt that a good many fires are attributed to electric wires, which should not be. At the same time, uninspected and doubtful electrical installations must be responsible for many fires of unknown origin.

I also believe that the careless and indifferent manner in which the daily papers invariably attribute all fires to electric wires has an equal tendency to create in the minds of careless or incendiary persons an equal indifference as to the effect of their actions. When the cause of fires becomes so stereotyped, the incendiary has a feeling that he can always receive the support of the press in his contention that fires were caused from electric wires.

W. H. Eisenbeis, New Secretary of Toronto Section A.I.E.E.

Mr. W. H. Eisenbeis, of the Canadian Westinghouse Co., Ltd., has been elected secretary pro. tem of the Toronto section of the American Institute of Electrical Engineers. The position was rendered vacant by the removal of the former secretary, Mr. W. G. Chace, of Smith, Kerry & Chace, to Winnipeg. Mr. Eisenbeis will make a most acceptable secretary for the section, and is expected to do much towards making the coming season as successful as any on record.

Refilling Burned Out Lamps.

The refilling of burned out incandescent lamps is a business now being carried on with gratifying success by the Dominion Electric Co., St. Catharines, Ontario. The managers of this company, who are experienced incandescent lamp makers, aim at effecting a substantial saving to both large and small business houses and manufacturing establishments by refilling burn-outs under a guarantee that they will give perfect satisfaction. They claim that their refills will stand all the tests of new high grade lamps for long life, candle power, voltage, general appearance, and all round efficiency, and they are open to make both large and small contracts for this class of work.

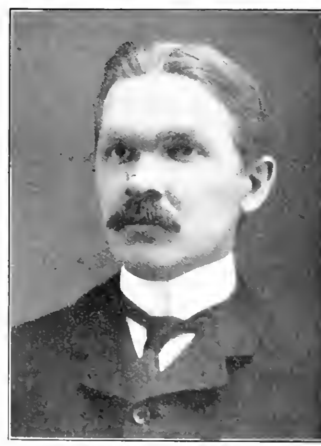
The authorities of Glace Bay, N.S., are installing 400 meters in connection with the municipal electric light plant, and are also adding about three miles of transmission lines to the system. F. W. Frizzel is manager.

Will Take Up Consulting Engineering.

Mr. J. M. Robertson, mechanical superintendent and superintendent of shops for the Montreal Light, Heat & Power Company, has tendered his resignation, to take effect at the end of September. Mr. Robertson has been connected with the Power Company or its predecessors for more than thirteen years, having been appointed assistant electrical engineer of the Royal Electric Company in 1895. Aside from an absence of about a year, during which time he was in charge of the electrical and mechanical work of the Montreal Park & Island Railway Company, he has been connected with the company continuously since that time, having during this period been identified with nearly every department of the company's business. The department in which his work is perhaps best known is that of "alternating current power supply," which he took charge of at its inception, and for the great development of which, he has been largely responsible.

More recently Mr. Robertson organized for the company, a "shops department," in which is manufactured practically all the electrical and mechanical apparatus and supplies required by the company, in addition to the carrying on of all repair and testing work required by the many branches of the company's business.

Mr. Robertson intends to enter the consulting engineering field and is opening an office in Montreal, where he will undertake engineering work in either the mechanical or electrical line. His wide acquaintance throughout Montreal and, in fact, throughout Canada, coupled with his acknowledged ability in his profession should ensure for him a successful career in his new field.



J. M. Robertson, Montreal.

Wickes Brothers, machinery manufacturers and dealers, Saginaw, Mich. have favoured us with their monthly stock list of boilers, engines, dynamos, motors and machinery. The list reveals the fact that they manufacture a great variety of useful machines and that their prices are exceptionally interesting.

The contract has been awarded by the B. C. Electric Company for the installation of a turbine water wheel of 11,000 horse-power. John McDougall, Montreal, secured the contract. This is part of the company's scheme to increase its power at a cost of $300,000.

QUESTIONS AND ANSWERS

GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS:

1. **All enquiries will be answered in the order received, unless special circumstances warrant other action.**
2. **Questions to be answered in any specified issue, should be in our hands by the close of the month preceding publication.**
3. **Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment, should be placed in the hands of a consulting engineer, cannot be considered in this department.**
4. **To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possible doubt as to the information required.**
5. **In all cases the names of our correspondents will be treated confidentially.**

Question No. 1.—(a) What is the correct way to ground the secondaries of a two-wire transformer? (b) Explain how grounding the secondaries protects them from high tension currents? (c) A 500 D.C. railway generator gives trouble at commutator. When it is newly turned up and sandpapered it commutates beautifully, but after running about two weeks or so it sparks so badly that it has to be turned again. The bars are rough and black at different places on commutator. Tests show that there are no bad connections between bars and winding. Please explain this.

Answer.—(a) A very satisfactory ground for transformer secondaries is obtained by using standard ground clamps, which can be obtained from any supply house, using a water pipe as the ground, and taking care that it is scraped clear of all rust or other corrosion before the clamp is put in place. If water pipes are not to be had, bury a copper or iron plate, the former preferred, in the earth, making sure that it is down far enough so as to be always surrounded by moist earth. Its surface can be increased, and the device thus made more effective, by bedding the plate in coke. A similar plate, or any old casting of reasonable size thrown into a lake or river, makes a fair ground, though scarcely as satisfactory as a water pipe. Plain iron pipe, driven down beside a pole, or a coil of wire underneath the butt of the pole, are also sometimes used, but the difficulty with them is that their surface area is not very great, besides which they may not be down far enough to strike permanently moist earth, thus making the resistance of the ground much higher than it should be. The connection between the secondaries and the plate should be as short as possible, it should be run with as few bends and turns as possible, it should be strong mechanically and of low resistance electrically, say No. 4 or No. 6 at least, and larger for groups of big transformers, it should be soldered to both the secondary and the plate, and should not be run through iron guard pipes unless soldered to them at both ends. Connect the ground wire to either side of the secondary of two-wire transformers, and to the neutral in three-wire work.

(b) Grounding the secondaries does not protect those secondaries, in fact if anything it puts a bigger strain upon them, but it does protect anybody who might happen to come in contact with them from the effects of any connection which there might be between them and the high tension primary. If the primary and secondary should become crossed, and the secondary were ungrounded, anybody touching it would be across the full primary potential, assuming that he were standing on the ground, as is usually the case. This would likely mean death, but if the secondary were grounded, he would either be shortcircuited by the ground wire, if it was connected to that side of the circuit which he touched, and would therefore get no shock at all, or else, if the ground wire were on the secondary wire, he would get a 110-volt shock. As a matter of fact, he would get this shock at any time that he touched that secondary, irrespective of whether or no it was crossed with the primary, but with a good ground on the secondary no cross between it and the primary can raise its potential more than 110 volts above ground, which is the important point to guard against.

(c) Questions like this are very hard to answer without seeing the machine itself, but we would suggest that perhaps some of the commutator bars are loose. This can be detected by tapping with a hammer, the remedy, of course, is to tighten the rings until all the bars are clamped firmly, though possibly you may have to put in some new mica packing as well. We would also suggest that you investigate the type of brush you are using, and see if it is suitable for this work. Further, it may be that the design of the machine is such that the commutation, under varying loads, is not as good as it should be, sometimes the horns of the field poles can be cut off for an inch or so with advantage, at the same time increasing the thickness of the brushes.

Question No. 2.—We are running a 60-cycle 110-volt 10 h.p. induction off a two-phase circuit, using two single phase meters for measuring the power used. Sometimes one of the meters runs backwards. Would you please explain this? I understood that this effect was possible on a three-phase circuit, but did not know that it ever was found on a two-phase line?

Answer. The reason for this is probably a difference between the voltages of the two phases. This difference in voltage causes more current to flow in one leg than in the other, the larger current, through its transformer effect upon the secondary, causing a little power to be sent back into the line through the low voltage phase, this, of course, making the wattmeter on that phase run backwards. The effect is most marked at low power factors, which means at times of light loads. The remedy, if you consider the matter serious enough to require a remedy, is to equalize the voltages on the two phases or to put in a polyphase meter.

Question No. 3. Can you give me a cheap plan for brazing or welding by electricity on bicycles and other small work; could it be run on an arc or incandescent circuit, or what size of dynamo would be required?

Answer. We do not know of any such apparatus being on the market, though the Thompson Electric Welding Co., whose address we believe is Lynn, Massachusetts, might possibly be able to give you some information that would be of use. Outside of their special designs, principally machines for electrically welding metal hoops and other small articles, and the processes developed by the larger electrical manufacturing companies for their own use, also electric bonding, we do not know of anything being done in this line. Perhaps some of our readers could help us.

Regarding the amount of energy required, we would judge that it would be comparatively little, say not exceeding two or three kilowatts at the outside.

New Dean of Engineering School for University of New Brunswick.

Mr. E. A. Stone, the recently appointed dean of the Engineering School of the University of New Brunswick at Fredericton, was born in Charlottetown, P.E.I., in 1870, and was educated at Montreal. He graduated at McGill University in 1891, as gold medalist in civil engineering, obtaining his degree of B.A.Sc. with honors. In 1894 he obtained his degree of Master of Engineering. Mr. Stone has been engaged in the following positions: 1891, railroad construction for the C.P.R.; 1892 to 1894, designing special track work for the Montreal, Toronto and other electric railway systems; 1894, construction of the Montreal Park & Island Railway; 1895 to 1899, designing and inspecting railroad bridges on staff of the chief engineer of the C.P.R.; 1899 to 1902, designing and constructing an electrochemical plant for the manipulation of chloride of lime and caustic soda by a patented process for the electrolysis of brine at Sault Ste. Marie; 1902 to 1907, assistant structural engineer for the Canada Foundry Co., engaged in superintending the designing of railroad and highway steel bridges and steel buildings; 1907, professor of civil engineering at Dalhousie College, Halifax. Mr. Stone is a member of the Canadian Society of Civil Engineers, and of the Society for the Promotion of Engineering Education and has written several interesting engineering papers.

E. A. Stone, B.A.Sc., M.E., New Dean of Engineering, University of New Brunswick.

The Billing-Coonan Co., Ltd., electrical engineers and contractors, have opened an office at 424 Union Bank building, Winnipeg. Both principals in this firm were formerly with the Canadian Westinghouse Co.

The Dominion Government has awarded the contract for the whole of the steel work at St. Andrew's locks to the Canada Foundry Company and the Canadian General Electric Company. The contract amounts to nearly $600,000, and includes all steel work on the locks, dam and bridge, together with the steam and electrical installations for handling the curtain locks.

Sparks.

The Lyons Electrical Company is installing a large generator in its plant at Burford, Ont., for the purpose of improving the lighting service in that village.

The newly organized Standard Construction Company are awaiting favourable conditions to extend the Windsor, Essex and Lake Shore Electric Railway from Leamington to Tilbury.

The Toronto Railway Company have just placed an order with the British Insulated & Helsby Cables, Ltd., Montreal, to supply and install the three-core extra high tension feeders in connection with their new extensions. The same firm have received a contract from the B. C. Telephone Company for over forty miles of air space telephone cables, ranging in size from 400 pair to 25 pair.

The new dam at the Orillia power plant, at the Ragged Rapids, which has been under construction for three seasons, was put into use for the first time last month. This is the third dam the town has built at the rapids. The present dam is a most substantial cement structure, built from the most improved plans, and under the most careful supervision. It has cost the town $70,000.

The city council of Nelson, B.C., have decided to reduce the price of electricity for lamps supplied from the municipal plant. The new rates will be as follows: First 50 k.w., 12 cents per k.w. hour; second 50 k.w., 11 cents; next 100 k.w., 10 cents; next 200 k.w., 9 cents; next 300 k.w., 8 cents; next 300 k.w., 7 cents; next 500 k.w., 6 cents; next 500 k.w., 5 cents, and all over 2,000 k.w., 4 cents. A discount of ten per cent. will be allowed on all accounts paid before the 15th of the month. G. H. Bolton is City Clerk.

Mr. David Wilson, formerly engineer in charge of the city of London Electric Lighting Company's works and now with the firm of Babcock & Wilcox, Oriel House, Farringdon street, London, Eng., visited Canada recently in the interests of the company. He looked into a number of propositions in Canada and enquired into the demand for the company's products in this country. During his visit, Mr. Wilson paid particular attention to the power development stations in Canada, especially those which are run by steam

The B. C. Electric Company will expend about $112,000 upon capital account during the present year, dating from July 1st last. An announcement was made some time ago that this would total over $100,000, and at a recent meeting of the officials of that company in Vancouver it was passed as follows:—Cemetery extension, $35,000; lighting extension, $30,000; railway feeders, $15,000; new buildings, $12,000; relaying tracks, $10,000; Gorge Park, $10,000; total, $112,000. In addition to this there will be an appropriation for additional rolling stock.

Hon. Adam Beck, Chairman Hydro-Electric Power Commission, took tenders until September 28th for the supply and erection of 63,500-volt single phase or 110,000-volt three-phase transformers for operation of the Commission's 110,000-volt transmission system and for the manufacture, supply and erection complete of the switching and indicating apparatus for the 110,000-volt transformer stations. Apparatus required for the following high tension transformer stations: Niagara Falls, step-up transformer station, Toronto, London, Dundas, Guelph, Preston, Berlin, Stratford, St. Marys, Woodstock, Brantford and St. Thomas step-down stations. We are informed that the awards will be made in three or four weeks.

Algoma Power Company's Plant.

The Algoma Power Company (head office, Berlin, Ont.) are now completing the construction of their power plant at Michipicoten Falls, Ontario, and at the same time are trebling the capacity by installing a second unit of 1,000 horse-power and a third of 400 horse-power as well as a separately driven exciter of 125 horse-power for the whole station.

Algoma Power Co.—Power Station.

This company's plant, although not completely finished, started commercial operation in January this year, having several gold mines in the Michipicoten district as its first customers. In August a contract was entered into with the Lake Superior Corporation for the supply of electric power for operating its Helen iron mine. This entails the immediate construction of a 12-mile transmission line from the power station, and the installation of electrical equipment in the mine of over 1,000 horse-power in motors, as well as the new generating apparatus at the power station. The contract for the supply to the Helen mine provides that all connections and current be ready by December 1st next, and the power is to be supplied 24 hours per day. The contract is for a period of ten years.

Algoma Power Co.—Wood Stave Flume.

Algoma Power Co. Canal and Forebay.

The Algoma Power Company have purchased the electrical equipment for both the Helen mine and the power station, and also a portion of the hydraulic apparatus from Allis-Chalmers-Bullock Co., of Montreal, the only firm in Canada to build complete hydro-electric plants and who are installing this plant; and the remainder of the hydraulic equipment from the Jenckes Machine Co., of Sherbrooke, Que. The transmission line is now under construction by the company's own force. The power unit will consist of a 1,000 horse-power single horizontal turbine water wheel direct connected to a 600 K.W. alternating current generator. For the exciter unit there will be a 60 K.W. direct current generator direct connected to a 110 horse-power turbine. Transformers will reduce the current from 10,000 volts to 600 volts. A large portion of the power will be used to operate the present mining plant, which will be changed from steam to electric drive by motors.

Mr. C. H. Mitchell, Traders Bank building, Toronto, is the engineer.

Trade Notes.

The Rogers Electric Company have removed from 134 King street west to 145 Queen street west, Toronto.

The Jones & Moore Electric Company are now located in their new factory at 296-300 Adelaide street west, Toronto.

It is reported that Philip Lahee, electrical contractor, Montreal, has made an assignment with liabilities amounting to $44,463.

The contract for new machinery for the electric light plant at Wingham, Ont., has been awarded by the town council to the Canadian General Electric Company, at $4,350.

Smith, Kerry & Chace, consulting engineers, Toronto, have received instructions from the city of Nelson, B.C., to prepare plans and specifications for the construction of extensions to its hydro-electric plant on the Kootenay river, involving machinery for a second unit having a capacity of 1,000 k.w., also transmission circuit and equipment for sub-station.

The Electric Repair & Contracting Co., one of the leading electrical concerns of the city of Montreal, have removed their offices and factory from No. 101 Lagauchetiere street west, where they were located for a number of years, to No. 119 Lagauchetiere street west. Their new premises contain ample space for the requirements of their constantly growing business, and they have erected a factory and machine shop where the heaviest class of apparatus can be handled with facility and despatch, while ample provision has been made for the handling of the lighter class of work.

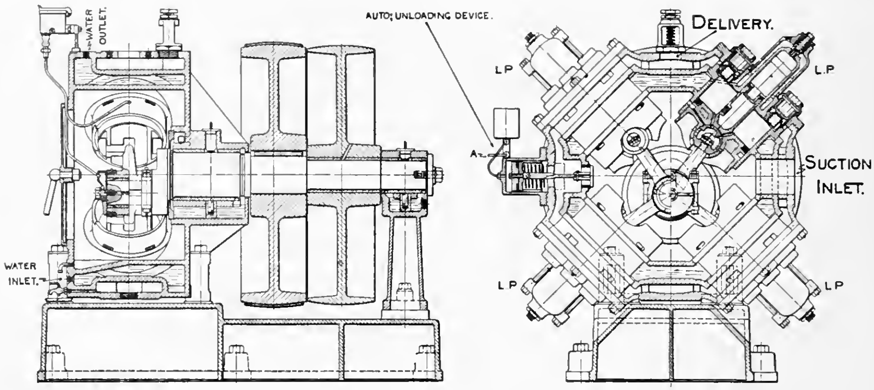
The company, as its name implies, takes contracts for all classes of electrical work. The members of the firm are electrical experts and have built up a large business as contracting electrical engineers, adjusters and appraisers and dealers in electrical apparatus, both new and second hand.

New High Speed Air Compressor.

An interesting exhibit at the Canadian National Exhibition was a new Reavell High Speed Air Compressor. As shown in the sectional illustration on this page, the Reavell compressor has four cylinders arranged radially in a circular shaped casing. Each of the four cylinders is fitted with a trunk piston, and the four connecting rods are all driven by a common crankpin. The casing contains an annular space through which the cylinders pass, and which is used as a water jacket. Each cylinder forms, as it were, a separate single-acting compressor, and as they all deliver into a common delivery passage, a practically continuous delivery of air is secured, because the compressor, owing to the pressure being always in one direction, can be run at relatively righ speed.

The section through the shaft bearing and casing shows clearly the circumferential delivery port. The section through the cylinders shows a small balance or pilot piston which is fitted to the larger sizes of these single stage compressors, in order to obtain the constant thrust which is the special feature of this compressor, as it ensures silent working, even after wear has taken place.

The compressor has no section valves, air being admitted above each piston by means of a port in the lat-



SECTION OF STANDARD BELT-DRIVEN SINGLE-STAGE AIR COMPRESSOR.

ter, which coincides with a similar port in the top of each connecting rod, during the suction stroke; and near the end of this stroke the piston overruns the ports cut through the cylinder wall, as shown, thus making direct communication between the cylinder and the inside of the compressor casing, which is arranged to form a suction chamber. This feature alone results in a gain of at least five per cent. in the volumetric efficiency, as compared with compressors having spring-loaded valves; the cylinders being filled with air at atmospheric pressure at each stroke, instead of a reduced pressure due to the resistance of the valve springs.

A special feature about the construction of this Quadruplex Compressor is the simplicity of construction and the ease with which the machine may be dissected for examination or repair; for on removing the nut which retains the end cap on the crankpin, the whole of the connecting rods and pistons can be removed without the use of a spanner. The connecting rods are of forged steel and the gudgeons of hard cast iron accurately ground. The arrangement of cylinders in this compressor makes it particularly suitable for electric driving. The torque on the shaft is practically contsant, and this enables the motor to work efficiently and without sparking. In small machines a standard high-speed motor is used, and the compressor is driven by gear wheels.

These machines for mining work are frequently fitted with wheels attached directly to the bed to make the whole machine portable. Larger machines have motors of a slow-speed type, so that they may be directly coupled to the compressor, enabling gears to be dispensed with. There are then only two bearings for the motor and compressor together, the field magnet cast-

(Continued on Page 36.)

Albert W. Vivian, electrical contractor, 828 Yonge Street, Toronto, has made an assignment.

MOONLIGHT SCHEDULE FOR NOVEMBER.

(Courtesy of the National Carbon Company, Cleveland, Ohio.)

Date.	Light.	Date.	Extinguish.	No. of Hours
Nov. 1	10 00	Nov. 2	5 50	7 50
2	10 10	3	5 50	6 40
4	0 20	4	5 50	5 30
5	1 40	5	5 50	4 10
6	2 50	6	5 50	3 00
7	No Light	7	No Light	
8	" "	8	" "	
9	5 20	9	7 30	2 10
10	5 20	10	8 10	2 50
11	5 20	11	9 00	3 40
12	5 20	12	9 50	4 30
13	5 10	13	10 50	5 40
14	5 10	14	11 50	6 40
15	5 10	16	0 50	7 40
16	5 10	17	1 50	8 40
17	5 10	18	2 50	9 40
18	5 10	19	3 50	10 40
19	5 10	20	4 50	11 40
20	5 10	21	5 50	12 40
21	5 10	22	6 10	13 00
22	5 10	23	6 10	13 00
23	5 10	24	6 10	13 00
24	5 10	25	6 10	13 00
25	5 10	26	6 10	13 00
26	5 10	27	6 20	13 10
27	5 00	28	6 20	13 20
28	5 00	29	6 20	13 20
29	5 00	30	6 20	13 20
30	10 10	Dec. 1	6 20	8 10
		Total...........		240 00

New High Speed Air Compressor.

(Continued from page 35).

ings being bolted direct to the bed-plate which carries the compressor, while the commutator is built up on a sleeve and fits on to the compressor shaft. For high pressure two or more of the cylinders are put in series with intercoolers placed in between so as to divide the work of compression into a number of stages, depending on the final delivery pressure. These machines are also made of the three-stage type, for pressures up to 2,000 pounds per square inch.

The negotiations which Mr. Jas. A. Ross, M.P.P., has been carrying on with capitalists in Toronto for the construction of the Dunnville, Wellandport & Beamsville Electric Railway are reported to have been successful, and a by-law to guarantee bonds to the amount of $30,000 will be submitted to the ratepayers on October 12th.

Sparks.

The ratepayers of Nelson, B.C., have approved a by-law to raise $85,000 for the installation of a second unit at the power station.

The B. C. Electric Railway Company, Ltd., Vancouver, have awarded the John McDougall Caledonia Iron Works, of Montreal, the contract for the supply and installation of a Doble impulse waterwheel at Lake Buntzen, the equipment to be 11,000 horse-power.

Mr. Marconi arrived in New York a few days ago. His object now is to complete and perfect the service between Canada and the other side. He said: "We have experienced great difficulty with the land lines from Canada, and want to get a big station nearer to New York. What we intend to do is to perfect the station at Cape Cod for receiving transatlantic messages there." Mr. Marconi said that the Cape Cod work probably will be completed by Christmas. Then his attention will be given to wireless work on the Pacific side of the continent.

Sparks.

Fire at the municipal electric light station at Brockville, Ont., last month caused damage to buildings and machinery to the extent of $10,000.

The Barber Electric Company, Ltd., capitalized at $25,000, has been incorporated for the purpose of carrying on the business of the A. F. Barber Electric Company, Vancouver, B.C.

The City Light Department of Kingston, Ont., is figuring upon the electric lighting of Portsmouth, and there is a possibility that arrangements will be made with the village council to extend the city system into the village.

Construction of the water power plant at Fort Frances, Ont., and International Falls will be gone on with as rapidly as possible. The dam, plant and machinery will cost about $700,000 and develop 30,000 h.p.

Tenders were received by G. C. Smith, Clerk, Boissevain, Man., until September 28th for apparatus for an electric light plant, including boilers, engine, generator, switchboards and street lighting apparatus. Alternative tenders for a gas producer plant instead of steam plant will be considered. Plans and specifications at office of W. E. Skinner, Ltd., consulting engineers, Winnipeg.

The city council of Lethbridge, Alta., have instructed Smith, Kerry & Chace, consulting engineers, Toronto, to design and construct a steam-electric generating station, which will involve the use of certain elements in the old station which has recently been purchased by the city from the Lethbridge Electric Company. The new station will be equipped with approximately 1,000 K.W. machinery, including steam water pumping unit, coal-handling apparatus, etc.

Sparks.

The Royal Electric & Gas Supply Co., Montreal, Que, have registered.

W. E. Skinner & Company have obtained the contract for the lighting of the new Grain Exchange building at Winnipeg with Nernst electric lamps.

The Blindman River Electric Power Company, Lacombe, Alta., contemplate the installation of an auxiliary steam plant. E. J. Tett is manager.

Notice has been given that application will be made to the legislature at its next session for permission to build an electric railway from Belleville, Ont., to Point Ann, a distance of about five miles.

Tenders for supply and installation of an electric equipment, also for the supply and installation of a steam driven pumping equipment, were received by W. W. Northcott, city purchasing agent, Victoria, B.C., until October 5th.

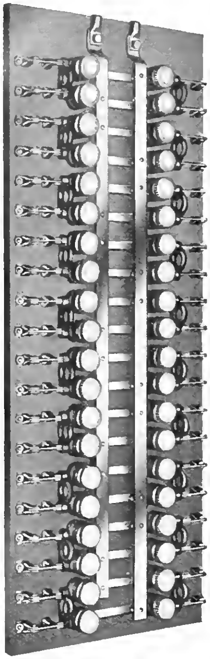
A report will be submitted to the Park Board at Portage la Prairie, Man., by Smith, Kerry & Chace, consulting engineers, Toronto, on a method of creating an artificial like by diversion of the water from the Assiniboine river.

The ratepayers of Edmonton, Alta., have approved of a by-law authorizing the council to purchase the Strathcona Radial Tramway for $10,000, and providing for the raising of $135,000 by debentures to put the system in operation.

At a recent meeting of the Town Council of Pembroke, Ont., the by-law to raise by way of loan the sum of $10,000 for the purchasing and installing of an electric pump and motor for pump house and an automatic trip valve for a stand pipe was introduced and read a first time.

The plant of the Lethbridge Electric Company, which has been purchased by the city, is to be removed and changed from simple to condensing. The improvements include new boilers and central station, and new 300 k.w. steam turbine or engine set. Arthur Reid, superintendent, Box 1417, Lethbridge, may be addressed.

By an agreement recently concluded between the Chatham Gas Company, Wallaceburg, and the Lake Erie Electric Railway, the former will supply from their own power house all the electric power necessary for the running of the entire railway system from Wallaceburg to Lake Erie. The gas company will install additional machinery and equipment for the purpose of this contract, the work being commenced at once.



Isn't it better to adopt "Hill" Panelboards

than to wish you had?

Positively the neatest and most substantial on the market. Plug or Cartridge Fuses.

With or without Main Switch.

Don't buy Boards or Cabinets before getting our price.

If you want something special send us a sketch and we'll do the rest—That's our business.

Hill Electric Mfg. Co.

1560 St. Lawrence B'v'd.
MONTREAL

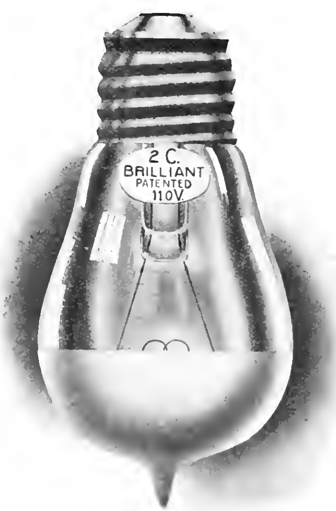
Monarch Electric Co.

Limited

579 St. Paul St., MONTREAL

Electrical and Mechanical Engineers and Manufacturers

Switchboards - Supplies
Commutators - Metal Novelties
Special 2,000 Volt Motor Starting Apparatus



A GOOD SIGN

Is the Result of Using

Brilliant Sign Lamps

No dark spots.

Every lamp burns.

Supplied either clear, with frosted tips, or all frosted, in 2, 4, and 5 Candle Power.

We manufacture a complete line of Incandescent Lamps, and are now in a position to supply Miniature and Candelabra Lamps.

Write for catalogue and prices.

Ontario Lantern & Lamp Company, Limited

HAMILTON, ONTARIO

Personal Mention

Mr. F. K. Martin, formerly superintendent of the electrical department of the Canadian Shipbuilding Co., Toronto and Niagara Falls, has been appointed manager of the municipal electric light plant at Battleford, Sask., as successor to Mr. W. R. Raymond.

Mr. Edward J. Haughton, the recently appointed superintendent of wireless service for the Pacific Coast, whose portrait is published herewith, was born in Dublin, Ireland, 34 years ago. He came to Canada in 1885, and was apprenticed to the law, but after two years' study, having no taste for the work, gave it up. After trying different occupations, he finally joined the C. P. R. service as a messenger. After serving as a messenger for a couple of years he was promoted to a clerkship. In the meantime he had made himself proficient in telegraphy. Two years later he was made junior operator and subsequently senior. He held the position of assistant chief until his appointment to be operator-in-charge of the Government wireless station at Gonzales Hill, Victoria, which position he occupied for eight months, and was then appointed as superintendent of wireless service for the Pacific Coast.

E. J. Haughton, Superintendent of Government Wireless Stations on Pacific Coast.

During his service with the C. P. R. Mr. Haughton had several offers from places outside of Victoria, which he refused to accept.

Mr. Matthew A. Sammett, Member C. E. Association, C.S.E., A.I.E.E., Montreal, has severed his connection with the Montreal Light, Heat and Power Company as engineer in charge of tests and designs, and has opened an office at 702 Canadian Express Building, in order to devote his entire time to consulting engineering. Mr. Sammett's long experience with the General Electric Company at Schenectady, N.Y., and as representative of the Montreal Light, Heat and Power Company on official acceptance tests for their various plants, as well as his connection with a number of other concerns, kept him in touch with the development of modern powerhouse work and long distance power transmission. His work will embrace estimates, reports, acceptance tests of apparatus purchased, and the preparation of specifications for electrical machinery, also supervision of plants of industrial enterprises.

Mr. Irving H. Smith, sales manager of the R. E. T. Pringle Company, Limited, manufacturers and dealers in electrical apparatus and supplies, has recently been appointed manager of the company for Western Canada, with headquarters at Winnipeg. He is one of the prominent and successful young men in the supply business in Canada. Nineteen years ago he entered the employ of the Edison General Electric Company, Toronto, which was afterwards absorbed by the Canadian General Electric Co. At that time the supply business, which he has followed ever since, was in a pretty small way. He commenced to travel early in his career for the Canadian General Electric Company for the selling of their supplies.

In September, 1901, Mr. Smith left the Canadian General Electric Company and accepted a position with Mr. Pringle, then a dealer in electrical supplies. In the following year the present company was formed as a joint stock company, manufacturing electrical supplies, etc. From its inception Mr. Smith was connected with this company as vice-president and sales manager. He lived in Halifax, N.S., for three years, in St. John, N.B., for one year, and is now making his home in Winnipeg. Five years ago Mr. Smith opened up the Winnipeg district for the R. E. T. Pringle Company, Limited. He has travelled from one end of Canada to the other, and is personally acquainted with the business in all its fetaures. In fact, there is scarcely a lighting plant in the whole of Canada which he has not visited. There is, beyond doubt, a great future for the electrical supply business in Western Canada, and with so successful a manager as Mr. Smith to attend to this field, the R. E. T. Pringle Company is certain of securing a large share of the business.

Irving H. Smith, Manager for Western Canada for the R. E. T. Pringle Co.

Canadian
Electrical News
& Engineering Journal

PUBLISHED ON THE FIFTH OF EVERY MONTH BY
HUGH C. MacLEAN, LIMITED,
HUGH C. MacLEAN, Winnipeg, President.
THOS. S. YOUNG, Toronto, Business Manager.
JAMES FISHER, Toronto, Advertising Manager.

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362
F. W. SCHERBARTH, Representative.
MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative
WINNIPEG - - - - Telephone 224. 404 Travellers Bldg
ROLAND F. HILL, J. R. HOOPER, Representatives.
VANCOUVER - Telephone 2248. Molsons Bank Chambers
GEO. A. GALL, Representative

ADVERTISEMENTS.
Advertising rates sent promptly on application Orders for advertising should reach the office of publication not later than the 1st day of the month. Changes in advertisements will be made whenever desired without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, copy and cuts should be received at least one week before date of publication.

SUBSCRIPTIONS.
The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.
Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.
Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

The Aluminum Lightning Arrester

Almost every year, for some time past, there have been material changes in the design of lightning arresters, each season's experience having enabled the manufacturer to improve on his previous year's output. Most of these changes thus introduced, if not all, have without question added very greatly to the value of the lightning arrester, but chief among them must be named the introduction of the aluminum arrester, quite a few of which have been installed during this year. This design marks a very radical departure from anything which has heretofore been on the market, though, of course, the principle has been in experimental use for some little time past, in that all previous arrangements of spark gaps, series resistance, magnetic blowouts, etc., etc., have been entirely eliminated in favor of an arrangement of aluminum plates immersed in a suitable electrolyte, hence the name of aluminum cell arrester.

The principle upon which this most ingenious equipment depends is simply that it is possible to form a film on the surface of an aluminum plate, by a charging process somewhat similar to that used in storage batteries, which film will have the remarkable property of preventing any current flow through it until the voltage be raised to a certain critical or maximum value. As soon, however, as the potential across the film reaches this critical point the resistance of the film practically disappears, allowing a heavy current to flow until the potential goes below the critical point, whereupon the current flow ceases, due to a reappearance of the film resistance, and normal conditions are restored. It will thus be easily seen that this new design is just about as beautiful an example of an electrical safety valve as could well be imagined; its action corresponding exactly with the mechanical safety valve on a steam boiler or an air reservoir. This being the case, it is more than likely to prove a highly satisfactory form of arrester, and to mark an epoch in the art of protection against lightning and other similar high potential strains, because that is simply what the problem consists of, namely, to get a device which will discharge freely as soon as a certain potential strain is reached, and which will interrupt that discharge and reset itself ready for the next cycle of operations as soon as the potential goes down to normal.

Death from Electric Shock

In view of the daily increasing use of electricity, and the consequently greater chances for coming in contact with wiring carrying voltages that may be dangerous to life, the question of electric shock and its consequences is naturally most important. For a long time back there has been considerable discussion as to the minimum voltage which will produce fatal results, also as to what is the exact action of the current which causes death. One frequently hears the claim that 110 volts will kill you, based on instances where death has resulted from contact with 110 volt wires, but it goes almost without saying that in cases like this the shock was not between wire and wire, but between wire and ground, and that it was much higher than 110 volts, due to a cross with some foreign and high potential wire at some not very distant point. A possible exception to this is that the surprise of the shock, supposing that it came from only 110 volts, was so great as to produce heart failure, but it is generally conceded that this can take place only in the case of persons already troubled with a very weak heart. Death under such circumstances cannot be charged against a 110 volt circuit, any more than could a moist tropical climate be blamed for the death of a consumptive who refused to keep away from it. Another theory that was seriously broached at one time, but which we believe is not maintained by later investigations, was that different nationalities were affected by shocks in a markedly different degree, it being said that Swedes were frequently killed by 250 volts, though it never

affected other men working alongside them. Then 500 volts, our standard railway potential, has often been accused of fatal effects, though we understand that practically no well authenticated cases of death from that potential can be found. The next standard higher voltage, namely, 1,100, may or may not be fatal, depending to a great extent on the contact made with it, but there is one thing certain, and that is, that it is approaching uncomfortably near the potential used at executions, namely, 1,400 to 1,700 volts. The very common 2,000 volt primary, or anything higher, is as near certain death as one can wish for, providing the contact with it be anything but the merest touch. As opposed to this, though, there are some fairly well authenticated cases of recovery after prolonged connection with lines of 15,000 volts, or even somewhat higher.

While the voltage is always spoken of as cause of death, it must, of course, be remembered that it is the current flow produced by the voltage, and not the latter itself, which does the damage. Hence the truth of the remark that the half ampere of current in an incandescent lamp will kill a man. It probably will, but it takes a lot more than the 110 volts which is producing that current in a lamp to make the same amount of current flow through the human body, from which it follows that the 110 volt wires will not even hurt you, let alone produce death. It is not definitely known just how the current acts on the body to produce death, though investigations which have been carried on indicate that the action is to stop the beating of the heart. From this it follows that the actual result of a shock depends to quite an extent on the points of contact, a current flowing, say, from the hand to the shoulder being much less likely to result in death than one which passed through or near the heart, for instance, from the shoulder to the foot. This effect on the heart is not accompanied, so far as is at present known, by any destruction of the various tissues of the body, except for the burns at the point of contact, though at one time it was thought that there was considerable action on the blood, resulting in more or less coagulation. In this connection it should be noted that a great many deaths from shocks received while working on poles are due, in all probability, to the fail which almost invariably results, and not to the shock itself. Recognizing this, Continental practice calls for the constant use of life belts, in fact we understand that in Germany it is illegal to climb without them. Doubtless many otherwise fatal accidents are thus averted, and if so the practice could be extended to other countries with great benefit.

The treatment of those suffering from shock is almost identical with that prescribed for cases of drowning, namely, clear the chest and throat of all impedimenta in the shape of collar and shirt, and they try to make the patient breathe. The detail directions for this naturally cannot be given in this space. Suffice it to say that, as immediate and continuous treatment is the great secret of success, it is the clear duty of everyone connected with electrical plants to familiarize themselves with the proper method of procedure in such cases. This, of course, does not mean that medical help can be dispensed with, as on the contrary a doctor should be set for at once, but in the meantime the lack of treatment in the first fifteen or twenty minutes can probably do more harm than the best of doctors can afterwards overcome by hours of the hardest work. The other point to be emphasized, after that of instant attention, is perserverance. Don't give up, except after long-continued effort, as the process, while very slow, will frequently yield the desired results in apparently hopeless cases if you do but keep at it.

The Dion Subaqueous System

The electric lighting of entrances to harbors or channels has long been standard in connection with lighthouses, but a system has recently been devised which, according to the claims made for it, is going to entirely revolutionize our present methods. The new plan, designed by a Mr. Dion, of Wilkesbarre, Pa., is to put the lights under the water, instead of above it, using a number of comparatively small units, the light from which would be directed straight upwards towards the surface, the channel thus being marked by a series of bright dots on the water.

It is naturally quite impossible to form any opinion as to how far the proposed system will be a success until it has been tried in actual practice for some time, but on the face of it the plan certainly has some strong points in its favor. Chief among these, to begin with, would be that of first cost, which obviously is very much in favor of Mr. Dion's proposed arrangement; in fact, it would also have a big advantage as far as maintenance was concerned. Then again the weather would have no effect on it, as large bodies of water are always quite calm after you get a little below the surface, which would be an important point. Another feature of very great value would be the ability to so control the lights, one after the other, as to render it possible to guide a friendly vessel into a harbor without giving any clue to a hostile fleet. In fact, so many advantages can be enumerated on behalf of the proposed layout that it will doubtless be investigated very thoroughly, there being innumerable situations where it could be installed to great advantage.

Sir Thomas Shaughnessy, president of the Canadian Pacific Railway, says that the company has spent $10,000,000 double-tracking the line between Winnipeg and Thunder Bay in the last year. It will now start on similar work to the coast, for which $50,000,000 of new stock was voted recently. The company is preparing to operate trains over the mountains for 700 miles by electricity generated by water power.

The Height of Platforms for Street Cars

Recommendations Adopted by American Street and Suburban Railway Association.

At the annual convention of the American Street and Interurban Railway Association held at Atlantic City during the week of October 19th, one of the interesting subjects brought up for discussion was the report of the committee upon standardization. This committee dealt, among other things, with the height of platforms on the cars, and recommended as follows: "That the standard height of platforms for interurban cars from the top of rail to the top of platform floor be 51 inches, and that the height for city cars from the top of rail to the top of platform be 31 inches."

Regarding the height of car steps the committee's report said that the heights of car steps are controlled almost entirely by a number of different factors connected with the equipment of the car, such as the diameter of the wheels, the character of the motor equipment and the kind and height of the draft rigging, etc. On account of the differences both in equipment and conditions, there is wide variation in dimensions. In view of these facts the committee did not consider it advisable at present to go farther than to recommend what it considered good practice as regards heights of car steps.

With this limitation, they suggested the following as recommended practice for interurban cars:—

Height from top of rail to top of tread of first step not to exceed	17 ins.
Height from top of rail to top of tread of second step not to exceed	29 "
Height from top of rail to top of tread of third step not exceed	40 "
Height from top of rail to top of platform floor not to exceed	51 "

The committee made similar recommendations for the heights of steps on city cars as follows:—

Height from top of rail to top of first step not to exceed	17 ins.
Height from top of rail to top of second step not to exceed	31 "
Height from riser from top of vestibule floor to floor of city car	10 "
Height from top of rail to top of third step not to exceed	40 "
Height from top of rail to vestibule floor not to exceed	51 "
height of raise from vestibule platform to floor of car	10 "

Several representatives of the Ontario Railway and Municipal Board were present, and entered into the discussion on the heights of steps. Mr. J. H. F. Wyse, engineer for the board, said that this subject was of especial interest to Canadians at the present time, as the citizens of several large cities were asking the Commission to lower the steps of city cars. He explained that the Commission occupied the same position toward the public and the railways as state railway commissions do in the United States. He said that some of the most prominent physicians of Canada had stated under oath that the high steps were injurious and dangerous, and the demands of the people could not be ignored. He said that the question concerned some twenty roads in Ontario, and that the Board was desirous of obtaining all the light possible on the subject. He thought that 17 inches was too high for the first step and demonstrated this by saying that this was but a trifle lower than the chair upon which the delegates were sitting.

President Simmons read a letter from Dr. Howard Kelley, of Baltimore, Md., entering a protest against the recommendation of the committee making the first step 17 inches from the rail. He said this was too high for the comfort of women, children and old people, and he said a lower step would expedite entrance and exit.

Mr. H. W. Blake, a member of the committee, stated that the New York State Association had gone into the subject thoroughly some years ago and had reached the same decision as the present committee. The committee realized that many roads could not adopt these measurements, hence they were recommended simply as good practice and not as definite standards.

Mr. Adams pointed to some of the limitations on city cars. In eastern cities they are limited to about 8 feet as the width across sills, and many roads could not get even this width on account of narrow devil strips. This limited the radiation of trucks, which in turn limited the height of steps. Certain roads overcome the difficulty by using maximum traction trucks, but with severe grades this is impracticable.

Mr. Olds said that in Milwaukee the trolley wire must be 18 feet above the rail. With the insulated trolley base used for single phase work the limitations are very narrow. They use 36-inch car wheels with a clearance from wheels to car floor of 4 inches, while the floor is 2 inches thick, thus giving 42 inches from top of rail to top of floor. This is about all they can get, and it is 9 inches less than the height of 51 inches proposed by the committee for interurban cars. In order to get the proper headroom, the Milwaukee company is working to get the car floor down to 40 inches and possibly 38 inches, and this can be done by the use of 33-inch car wheels. This plan would give a low step. Mr. Olds agreed that many steps were too high, and frequently on unpaved streets or in boarding an interurban car in the country, a woman was obliged to step 22 to 24 inches, which was altogether too high. He said that the Chicago roads were having trouble with high steps on the new pay-as-you-enter cars.

Mr. Roberts thought the Toronto companies could get a 14-inch first step if desired, as they were not limited by subways.

Mr. Windsor made a motion to add the words "not to exceed" in the recommendations regarding heights of city and interurban car steps. This motion was adopted.

The Toronto Street Railway is feeling elated at the result of the international fender test held in Pittsburg, Pa., when the Watson fender was awarded the highest number of points for efficiency. The Watson fender is practically an output of the railway company, as the inventor made the appliance in the company's shops.

It is said that there is one telephone for every 24 persons in the Island of Guernsey. The system has been in use since 1898.

The Hydro-Electric Accumulator Apparatus

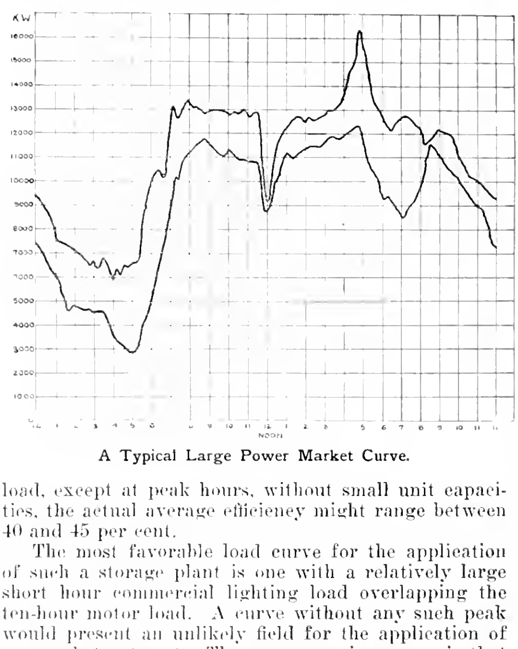
An Interesting Paper on a New Subject, Read by Edward Richards before Toronto Section A.I.E.E.

Any apparatus or plant for the storage, directly or indirectly, of electric energy may serve either one or both of two purposes. 1. It may be charged and carried simply as a reserve against breakdowns or interruptions in the service. 2. It may be discharged at certain periods of maximum demand, supplementing the generating capacity of the plant, and again charged during corresponding periods when the demand is less than the capacity of the generators. An electric storage battery cannot serve both of the above purposes up to its capacity. If it is used on regular charge and discharge, it cannot at the same time be held in reserve. The plants for the two separate purposes would be considered as separate investments. On the other hand, a hydro-electric storage plant of any given capacity may serve both of the above uses according only as it has reserve water in storage after the regular day's discharge. In the case of an electric storage battery in railway service, these periods of discharge are frequent and of short duration. A battery for the transfer of load in a light and power plant would discharge only once per day in all likelihood and for any material reduction in demand on ordinary load curves, this discharge would have to extend over an hour or more.

A large electric storage battery for a discharge extending over a period greater than one hour is an impracticability, because of the excessive investment required. Hydraulic storage, therefore, presents the only possible medium for load curve correction in ordinary lighting and power work. The reason for this lies in the fact that in such a storage plant the only two items of investment affected by the period of daily discharge are those for reservoirs and pumping plant. From the standpoint of the steam plant engineer the idea is in no sense a feasible one, because he deals with energy, and he must choose a medium for the storage of his energy with an efficiency as high as can be obtained. In hydro-electric plants where the conservation of water is necessary and possible, this method of storage will be of no interest, because of its low efficiency, but in cases where water is not a consideration or cannot be stored, such a plant may under certain conditions prove to be an auxiliary of considerable economic value.

It will be evident to all that the most favorable field for such an undertaking would be in connection with an expensive hydro-electric generating plant supplying power over a long transmission line in a power market where fuel cost and other conditions make it possible to supply economically a load of very low load factor. In such a case there is a combination of heavy investment in generating station and transmission line, with a load curve on which a storage plant may be worked with a relatively small reservoir investment. It will also be clear that as the general investment decreases and the load factor increases it becomes more and more unlikely that the idea can be applied economically. A suitable site would be a prime requisite. Natural conditions must be such as would make the construction of water reservoir or reservoirs as simple and inexpensive as possible. Both upper and lower levels should be large flat surfaces to avoid large variations in head. The difference of level between these two surfaces should, of course, be as great as possible. The nature of the soil of the upper level, and in some cases of the lower, should be such as to retain the water to as great an extent as possible, and there must be water available to compensate for leakage and evaporation.

The plant itself would combine turbines, turbine pumps and electric generators and motors. Inquiries have been made of European turbine manufacturers as to the feasibility of a double-ended unit, in which the electric generator would serve also as a motor for pumping. Doubt was expressed as to the possibility of constructing clutches capable of carrying such capacities as would be desirable, and of being readily disconnected. They, however, advised running either hydraulic unit dry while the other would be working. The full load efficiency of such a combination would range somewhere between 50 and 55 per cent., but as no ordinary load curve would permit of working at full



A Typical Large Power Market Curve.

load, except at peak hours, without small unit capacities, the actual average efficiency might range between 40 and 45 per cent.

The most favorable load curve for the application of such a storage plant is one with a relatively large short hour commercial lighting load overlapping the ten-hour motor load. A curve without any such peak would present an unlikely field for the application of any such treatment. The accompanying curve is that of a well-known large power market reduced in the equal proportions throughout. It shows a comparatively high load factor, namely, 67 per cent., on the upper winter day curve, and 75 per cent. on the lower summer day curve. The upper curve could be rectified to 12,000 k.w. demand by a plant with a generator capacity of 4,000 k.w., with an average overall efficiency of conversion of 40 per cent. The summer day demand could be reduced to 10,000 k.w. under similiar conditions, utilizing 2,400 k.w. of generator capacity.

The problem of determining whether hydro-electric storage could be made an auxiliary of any value or not,

might be classified under one of four heads as relating to cases where (1) the contract is on the basis of the yearly maximum demand; (2) the contract is on the basis of the monthly demand within certain limits, as in the case of the contract between the Hydro-Electric Power Commission and the Ontario Power Company; (3) the contract is the basis of the metered energy; (4) users and producers of the power are combined in the same interests. It will be noticed that these four cases are classified in the order of their simplicity.

In the first case the annual reduction in the cost of the purchased power, affected by the plant, is to be balanced against the annual fixed and operating charges on the storage plant. In such a case, with such a load curve as the one here presented, 4,000 k.w. would represent the annual reduction in demand, and nothing would be gained by reducing the summer demand below 12,000 k.w., the storage plant practically lying idle during the months of minimum summer demand.

In the second case, the average of the reductions in monthly demands must be balanced against the annual cost of the storage service. With the accompanying curve the maximum reduction is 4,000 k.w., the minimum is 2,400 k.w., and the average would approximate 3,200 k.w., assuming that the curve of demand would vary evenly between the two curves shown.

In the third case such a method of storage could be of no economic value to the purchaser, but might be applied on behalf of the producer and vendor. It will, however, be seen that such a basis of purchase is an entirely abnormal one in the case of any hydro-electric enterprise in which such a consumer represents any large proportion of the total output of the plant.

In the fourth instance the case is much more complicated. The development may be of a nature where a very large part of the total investment for generating plant is fixed for all outputs, or it may be such that the investment is more nearly proportioned to the output. If a storage plant could be installed to supply a certain portion of the daily demand more cheaply than the corresponding generating, transforming and transmission plant, it would be given the preference.

In the above cases no mention has been made of the value of reserve capacity of such a plant in cases of interruption of the service over the transmission line. This value would range, depending on the class of custom supplied, from nothing up to the cost of a similar service from any other source of reserve power, such as storage batteries, reserve steam or gas plants. In considering a reserve steam or gas plant it should be noticed that the hydraulic storage plant, to effect a 4,000 k.w. reduction in winter demand on such a curve as here presented, must supply power over a period of twelve hours. The operating cost of a steam or gas plant for a similar service would be a serious item.

If a site were available with ample water storage for any considerable reserve after the ordinary day's run, such reserve water would warrant the installation of considerable spare capacity simply for reserve. These reserve units could ordinarily be operated as synchronous condensers, and in that capacity pay their own fixed and operating charges many times over.

In conclusion, it may be stated that upon investigation it will be found that there are sites suitably located which may be developed for such a purpose to work on such a curve as the one here illustrated, which may be developed with high-class equipment for a working capacity of 4,000 k.w., reserve equipment for 3,500 k.w. additional, with water in storage for 15,000 k.w. hours at the end of any full day's run, for a capital outlay not exceeding $400,000. The annual cost of the service would not exceed $8 per horsepower of actual average reduction in monthly demand in the station on the K.V.A. or apparent power basis, if the power factor could be corrected between the limits of 80 and 90 per cent.

City Engineer Rust has advised the Board of Control that some action should be taken to prevent the Toronto Electric Light Company from erecting poles and lines, and constructing underground work, in view of the fact that the city will soon supply electricity to the citizens. "Would it not be advisable to take steps to prevent the Electric Light Company from carrying on this work, which will, of course, result in duplicate lines and conduits being placed on the streets?" Mr. Rust asked. It seems, however, that the city has not the necessary power to prevent the T. E. L. Co. from extending its service.

Mr. Wm. Meredith, an American consulting hydraulic engineer, has prepared a report on the suitability of the Jordan River, Vancouver Island, as an additional source of supply for electric power for the British Columbia Electric Street Railroad Company. The company has made an appropriation of $1,500,000 to establish an additional power plant on the Jordan River as soon as a suitable location can be found, as more power is necessary in Vancouver, B.C.

Trade Enquiries.

The Dominion Government Trade and Commerce reports contain the following trade enquiries. Readers of the "Electrical News" may obtain the names of enquirers by writing us, enclosing stamped envelope and stating number of enquiry:—

1587. Electrical Supplies.—A firm of general import merchants wish to hear from Canadian manufacturers of electrical supplies suitable for English use, such as lamps, motors, etc.

1611. Dry Cells.—A Manchester electrical firm will be glad to correspond with Canadian manufacturers of dry cells.

1643. Engineering Goods.—A well-connected firm of engineers' agents and merchants in the north of England ask for catalogues from Canadian manufacturers of mechanical appliances or engineering requisites suitable for English use.

1656. Engineering Goods.—A firm of general merchants and agents are seeking the agency in the north of England for Canadian-made engineering goods.

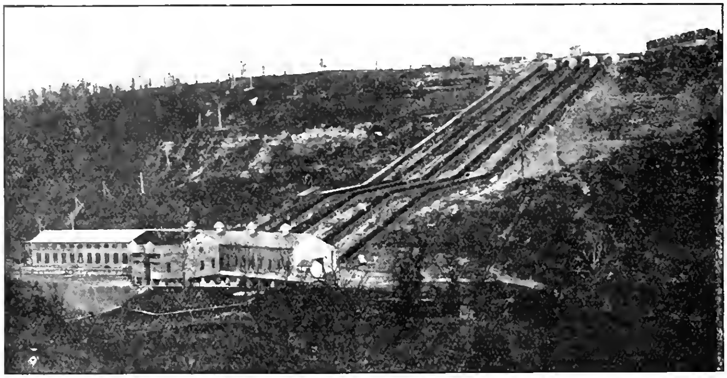
1671. Belting.—A Yorkshire firm manufacturing leather machine belting, main driving and dynamo belts, fire-hose, waterproof and india-rubber goods, etc., wishes to extend business connections in Canada.

1679. Agency.—A Birmingham firm manufacturing every description of electrical appliances wishes to get into touch with a thoroughly enterprising and energetic firm of undoubted stability in Canada to take up their Canadian agency.

Messrs. Henry Birks & Sons have placed on order for 25 single glower Nernst lamps through the Canadian Westinghouse Co.'s Vancouver office. This is in addition to the multiple glower lamps installed previously.

The Electrification of the Welland Canal

Illumination and Lock Gate Operation from over One Hundred Five Horse Power Motors.

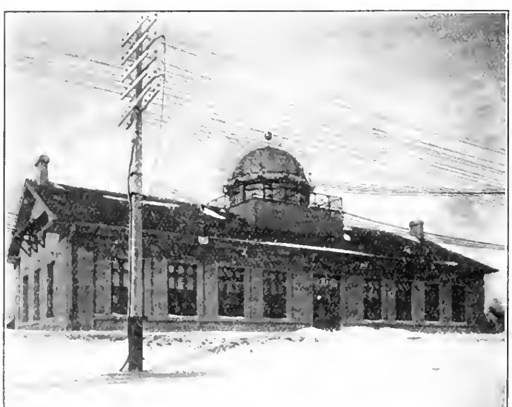


Dominion Power and Transmission Company's Power House.

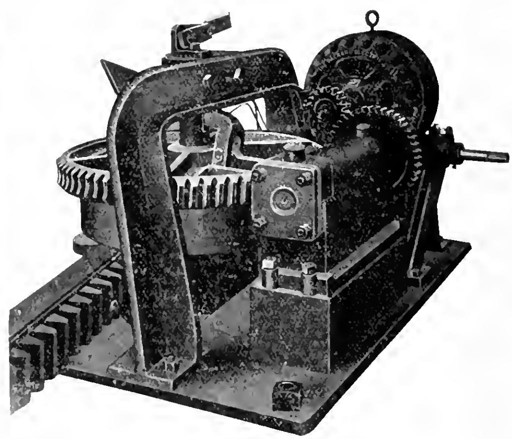
Since the Dominion Government gained control of the Welland Canal in 1841, many improvements have been made in its equipment:

The entire length of the canal is now electrically illuminated, requiring over 600 arc lamps.

The latest, and one of the most important improvements made since the opening of the canal, is the installation of lock opening and closing mechanisms, which are operated by induction motors. The motors are directly geared to the mechanisms, which operate the gates through a friction clutch, the whole being housed in galvanized iron boxes or covers at each lock, where the attendant merely has to throw in the reverse or forward switch for opening or closing, special switches being provided, the handles of which extend outside of the housing within easy access of attendant. The old method of opening by manual labor required about six minutes for each pair of lock gates, while with the new machanisms operated by induction motors, the time taken is only 35 to 40 seconds. This means a saving in time to a vessel going through the canal, of about three hours, besides eliminating tedious waits and delays in the locks.



Transformer Station at Thorold, Showing Reinforced Concrete Pole and Method of Lamp Suspension.



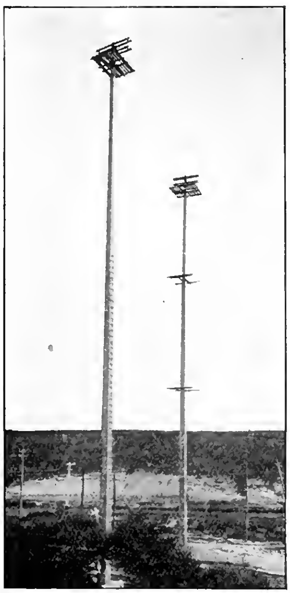
Showing Motor Geared to Mechanism.

There were required for this work over one hundred 5-horse-power motors, and tenders were asked by the Department of Railways and Canals, each manufacturer submitting a motor for test. The Packard Electric Company, Limited, St. Catharines, was awarded the contract. The motors are the squirrel cage type, 220 volts 3 phase, 1,200 revolutions, with special shaft for gearing to mechanism.

Special attention was given to this matter of insulation, the coils being thoroughly impregnated by the vacuum process, after being placed in position in the

slots, rendering them impervious to moisture, and the mechanical strength being such as to reduce the liability of burn out from any cause to a minimum. Experimental tests were made to prove the insulation, and after prolonged and repeated immersions, convincing proof was given that the motors are peculiarly adapted for operation in damp places.

The current required for operating the motors is supplied by the Dominion Power and Transmission Company, Limited, from their Decew Falls power house situated about two miles from the city of St. Catharines. It is transmitted along the canal at 2,200 volts, and fifty-five of The Pakard Electric Co.'s latest Core type transformers, ranging in capacity from five to twenty-five kilowatt, are used to reduce the voltage to that required for the motors.



150 ft. Reinforced Poles, on which several Power Circuits Cross the Canal.

The Welland Canal has up to date cost $26,000,000 for construction. It has 25 locks, 2 pair of guard gates and 23 bridges. The distance covered is 26 3-4 miles and the difference in level is 326 feet.

Electrification of the N. Y., N. H. & H. Railroad.

William S. Murray, electrical engineer of the New York, New Haven and Hartford Railroad Co., which has been operating the Westinghouse single-phase electric railway system on a part of its lines during the last two years, in discussing their experiences with electrifications, says:—

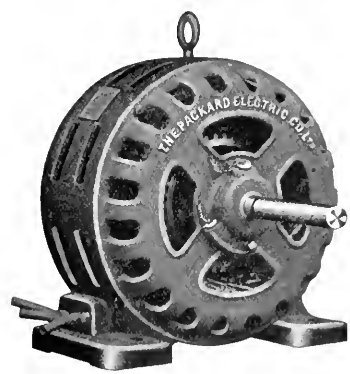
"The most commercially valuable answer as to the success of electrification on the New Haven is written in the actual operating schedule in the electrification zone. The train minute delays suffered to-day by electrical operation are but a small percentage of those incurred during the period of steam operation. As the zone limits in our case were not a terminal proposition, the application of the direct current showed itself to be impracticable. On account of errors, always common to initiative work, the first few months' operation has been a period of interruption which has naturally been annoying both to the road and the public. To-day the delays have disappeared by the removal of their cause.

"The wisdom of the purchase of a locomotive consisting of two individual half units, the whole or half unit being operative by a single crew, has proved itself in the ability of the road to handle 75 per cent. of traffic with half unit locomotives, using the whole unit on the remaining 25 per cent. of trains, whose weight demands the full drawbar. Should future requirements see the advantage of extension of electrification east of Stamford, the system is designedly applicable.

"As to the saving in cost of operation as compared with steam, I would state that operation to-day has not been of a sufficient length of time to make this comparision. It may be interesting to note, however, that by exhaustive investigation I have found that one pound of coal burned under the boilers of our central station produces twice the drawbar obtained by one pound of coal burned in the fire-boxes of the steam locomotive, or, in other words, the fuel bill for electric traction is one-half of that required for steam traction. Other economies will arrive in the low cost of maintenance and repairs of the electric locomotive as against steam locomotives.

"The density of traffic is, of course, the paramount feature as to the savings to be effected by electrification. It is not to be forgotten that, in electrifying, interest, depreciation, insurance and taxes follow closely on the heels of the capital investment in equipment and material necessary to electric operation. The heavier the traffic, the greater will be the economies derived from the two above-mentioned sources.

"The greatest value to be experienced by electrification will be in the tremendously increased traffic capacity of the present track mileage, due to the facility electricity offers in making rapid main line and yard train movement, or, stated in another way, it is thus immediately seen that electrification will permit a tremendous increase of traffic without an increase of track mileage, and thus roads which are faced with the requirements of handling their congested traffic by laying new tracks, which, of course, is the most expensive procedure on account of right-of-way difficulties, will be led into providing an equal capacity by electrification of the old trackage."



5 H. P. Packard Type "D" Induction Motor. Used in Welland Canal Equipment.

St. Johns Electric Light Company's Equipment

Description of the Plant Which Supplies Light for the Towns of St. Johns and Iberville, Quebec.

Illustrations of the plant of the St. Johns Electric Light Co., Limited, at St. Johns, P.Q., are published herewith. Up to three and a half years ago, this company operated a single phase, 133 cycle steam plant. They then contracted with the Montreal Light, Heat & Power Co. for a supply of power at their Chambly power house on the Richelieu river, twelve miles below St. Johns. The company then constructed from St Johns to Chambly, a three-phase, 25,000-volt line, bringing water power up to St. Johns. In December

St. Johns Electric Light Company—The Power House.

1904 they began to give a 24-hour service, and have continued it successfully up to the present time. At Chambly the company have special connections with the Montreal Light, Heat & Power Co. Their line runs parallel with the Chambly canal and the Richelieu river. The pole line is designed to carry two 3-phase 36-inch triangle lines. In the transformer house the company have an equipment of lightning arresters and a 25,000-volt oil switch and transformers. After entering the transformer house the current is carried to the switchboard in the engine and generator room of the steam plant.

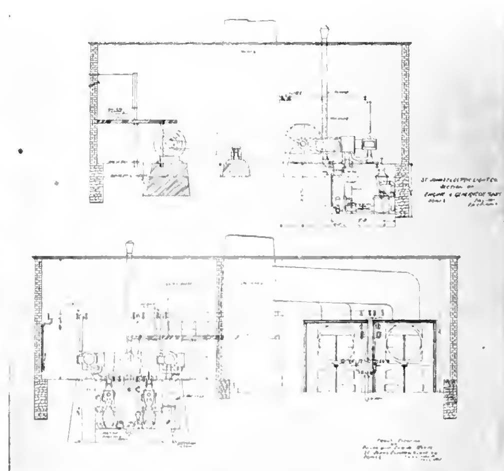
The steam plant consists of two 250 horse-power

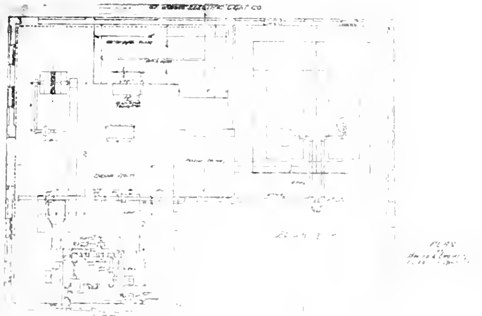
St. Johns Electric Light Company—Tne Transformer House.

St. Johns Electric Light Company—Engine and Generator Room of Steam Plant.

boilers, two 200 horse-power Lenard-Ball tandem compound condensing engines, belted to one 120 K.W. 3-phase 60 cycle S.K.C. and one 115 K.W. 3-phase, 60 cycle Allis-Chalmers-Bullock generators. Each engine has its own condenser and pump and each generator its own exciter. The steam plant is used as an auxiliary and also to take care of peak loads. The switchboard was designed so as to be as simple as possible. It has a double set of three-phase bus-bars placed on the floor at the rear of the board in a sort of chamber which ensures perfect safety when working behind the board. This is an inexpensive way of getting rid of the danger of having bus-bars mounted upon the rear of the board frame.

The St. Johns Electric Light Co. supply both St





Johns and Iberville, which is on the opposite side of the river. The combined population is about 8,000. The company have about 5,000 lights connected and about 200 horse-power in motors. Mr. F. A .Chisholm, whose portrait is published herewith, is managing director and secretary-treasurer of the company. Mr. R. S. Kelsch, C.E., Montreal, has been consulting engineer for the company for a number of years. The president of the company is Mr. James O'Cain, St. John's.

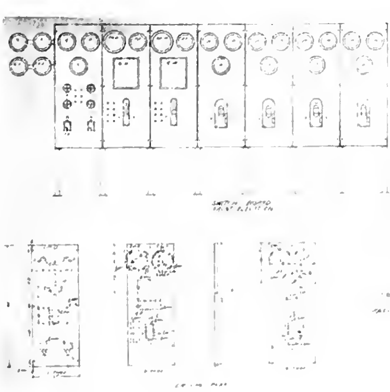
The St. Johns Light Co. has recently acquired at a sheriff's sale the plant of the St. Cesaire and Iberville Hydraulic and Power Co., of St. Johns. This company had had a very unfortunate career. It was formed to bring power from the Yamaska River. The company fixed prices at a very low figure, which was said to be lower even than the cost of production, and financial trouble followed. The plant, having been sold by the sheriff, was acquired by a party who continued to run at the low prices, which led to further financial difficulties, and a second time the plant was sold by the sheriff, and acquired in the interest of the old established St. Johns Light Co. The town of St. Johns has now made a contract with this company for

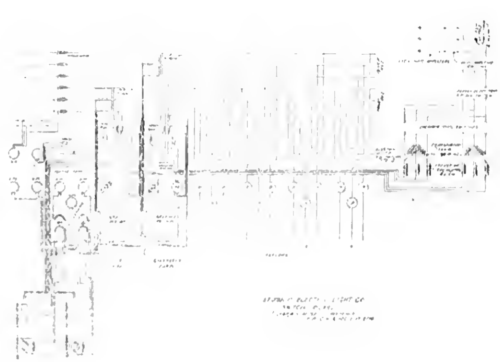
F. A. Chisholm, Managing Director and Secretary-Treasurer, St. Johns Electric Light Co.

seven years, and established prices for commercial lighting, which, although very low, considering the cost of production in St. Johns, still will probably enable a dividend to be earned on the invested capital, which has been impossible heretofore.

The first sale of the St. Cesaire & Iberville plant was at a price of $20,000 in 1906, and the second sale was for $15,000 in August, 1908.

The Dodge Monufacturing Co., of Toronto, Limited, have issued a new catalogue, No. B7, giving full details and prices of their power transmission machinery and elevating and conveying machinery for all purposes. The catalogue is well bound in limp cloth and extensively illustrated. It will be useful to anyone in need of such classes of machinery.





Some Practical Notes on Transformer Testing

Ideas obtained after experience of various methods.
Paper by E. M. Wood, in "Applied Science."

It is not the intention of the writer to try to write a treatise on the subject of transformer testing, but to offer a few pracical notes based on experience on certain methods, which do not come within the scope of the instruction given in the School.

The purpose of commercial testing is twofold: first, to make sure that the construction of the piece of apparatus is mechanically and electrically correct, and secondly, to give the engineering department data to check the correctness of their designs, constants, etc. Tests made for the latter purpose are usually omitted on apparatus that is "standard," that is on apparatus of which considerable number of units have been built to the same specifications. The first few machines built under new specifications should have complete tests.

The first class of transformers whose testing we will discuss is the small "lighting" transformer, usually of less than 100 k.w. capacity. Since these are turned out in comparatively large numbers in standard sizes, voltages, etc., it is essential that the tests on these should be sufficient and, at the same time, not take too much time. The standard tests are for insulation, polarity, conversion or voltage ratio, losses, regulation and heating. The insulation tests are of two sorts: the high voltage test to detect grounds, and the short circuit test. This latter test consists in applying double or triple normal voltage to the secondary winding of the transformer. This gives double or triple the normal voltage between turns in the winding and causes a short circuit and burn out if the insulation between turns is weak. To avoid large exciting currents the highest available frequency is used. (In all testing departments the low-tension side is called the "secondary" and the high-tension side the "primary.")

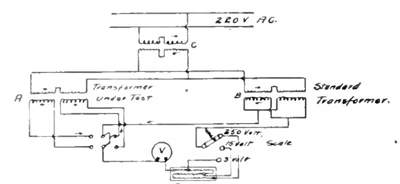
The conversion and polarity tests check the proper winding and assembly of the coils. A rather neat scheme for taking polarity and conversion at once on a transformer of standard voltages is shown in Fig. 1.

The transformer under test A and a transformer B of the same voltages and ratio, whose ratio has been carefully taken by voltmeters, are connected in parallel on the primary side, and both excited from a suitable transformer C, as shown. Then each secondary coil of A is connected in turn, as shown, in series with the standard secondary and a voltmeter, so that if the polarity is right, the units of the two coils oppose each other. If conversion and polarity are right there will be no voltmeter reading. The voltmeter should be provided with taps in its resistance so as to give, for example, 250, 15 and 3 volt scales. The 3 volt scale is necessary to show whether or not the conversion is exactly correct, but when first connected the voltmeter switch should be on the 250 volt connection (i.e., if the transformers have about the standard 110 volt secondary coils), so that the meter will not be damaged if the polarity happens to be wrong. Of course, a wrong polarity on a coil will show by adding the units instead of subtracting, and the meter will read 220 instead of zero.

Core losses and copper losses are taken by wattmeter by well-known methods. Frequency should be correct and the wave shape of impressed voltage sinusoidal, or else the wave shape and the relative core losses due to this shape and to the sinusoidal wave should be known. Since the readings on the wattmeter are small, the meters should be connected so that each meter reads exactly what it is intended to read; errors due to power taken by other meters being generally not negligible. Proper connections are shown in Figs. 2 and 3.

For core loss, the voltage should be set, then the voltmeter circuit opened and watts read, then wattmeter pressure circuit opened and exciting current read. In the impedance copper loss test the current is set with all pressure coils open, then impedance volts and then copper loss watts read separately. All current coils should be protected by short circuiting switches. This is a precaution that should be taken in all testing work.

The heating test usually consists in running the transformers in pairs under core loss and a small overload copper loss for a couple of hours. The method will be considered in detail later. This test is merely a load run to show up weak spots. The tests for heating are



made when the type is under development, and not necessary on the article after it has become standard.

Practically the same tests are applied to large power transformers. However, as these are not so well standardized as the smaller types, special methods have to be employed.

Conversion is best taken after the core has been built up, but before the transformer has been completely assembled, because with the large "slab" wound transformers with many coils it is easy to get coils interchanged, or wrong way around, and the transformer has to be torn down. The best procedure in taking conversion is to first make out from the winding specifications a diagrammatic scheme of the windings, showing the number of turns, the location of taps, ends of coils, etc. Then a suitable number of turns in a coil is taken as a primary, a voltage of so many (say 2 or 10 or whatever is convenient) volts per turn is impressed and voltages on the other sections read. The volts per turn for each section should be the same. The laying out of the scheme for taking conversion requires some ingenuity and a knowledge of the meters, potential transformers, etc., available. Voltmeters for this purpose should be kept carefully calibrated.

Core loss is taken in much the same way as in case of small transformers. The method or order of connecting the meters in circuit is scarcely so important as meter losses are negligible. Wave form of impressed voltage is as important as before, if comparison between different transformers is desired. It is custom-

ary in some places to take an oscilligram of applied voltage under some standard conditions, for example, normal voltage on transformer. This is filed with the test report for reference.

Any available part of the winding with sufficient number of turns to keep within reasonable limits the magnetizing current necessary to produce the normal voltage core flux, may be used as an exciting coil, and to it should be applied its proportion of the normal working voltage. This will produce normal working

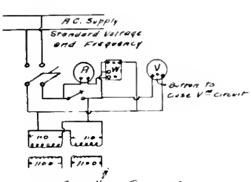


Figure 2— Core Loss Connections

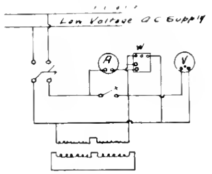


Figure 3 — Impedance Connections.

flux in the core and normal core loss. The coil should be so chosen, if possible, that its voltage is less than 3,000 volts, as below that voltage it is safe to use resistance multipliers in the pressure circuit of the wattmeter. These are more satisfactory than the potential transformer, as the latter does not have its primary and secondary voltages in exact opposition in phase. This causes the wattmeter to read too low.

Copper loss and short circuit impedance volts are taken by the usual short circuit test. Resistance of primary and secondary windings with connections for the short circuit test should be found, and the connected and observed total copper loss should check very closely.

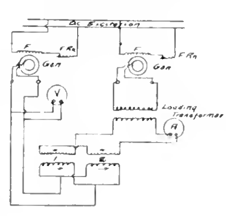
Resistance may be taken by D.C. drop of potential method, or by Wheatstone Bridge. In taking resistance by bridge, it is advisable to keep the "battery key" closed until the reading is completed, to avoid the great self-inductive "kick" when it is opened. Incidentally, this necessitates the use of a good battery in connection with the bridge. For the P. D. method a storage battery or D.C. exciter may be used, with suitable rhostats in series. The cores of large transformers seem to possess considerable magnetic inertia, so in order to avoid disturbances and variations of the voltmeter readings, as the magnetism in the core is gradually built up by the effect of the direct current in the windings, it is well to apply current up to about twice the value it is intended to use, hold at that value about a minute, then reduce the current to the required value, and close the voltmeter circuit. If the voltmeter needle is steady and does not "creep" towards lower readings, the meter readings may be taken. In order to damp out variations in D.C. current, the winding that is not having its resistance measured may be short circuited on itself. Connections for voltmeter should be made nearer the winding than the connection points of current leads and transformer leads. This arrangement insures against including the contact resistance of the leads in the resistance of the transformer coil.

Heating tests on power transformers are necessarily made with more care than on lighting types. The iron and copper losses are supplied as follows: The transformers are connected as shown in the diagrams 4 and 5, "bucking" if two of a kind are available, and "open delta" on the primary side of three are under test.

Take the case where two are under test. The core losses are supplied by exciting the two secondaries in parallel, up to normal working voltage, by a suitable generator, with or without an auxiliary tarnsformer. The impressed voltage is adjusted by varying the field of the generator. The secondaries should be connected in series, as shown in the diagram No. 4. This causes the primary E.M.F.'s to be opposing each other or "bucking," and the voltage across the two is zero. If an A.C. voltage at any convenient frequency be applied here equal to the sum of "impedance" voltages of the two transformers at that frequency, full load amperes will be forced through primary and secondary windings of both transformers, for, as will be seen by the diagram, the secondary connections form a short circuited secondary to this primary "impedance" voltage, as in the impedance test. This current then supplies the copper loss, and does not unbalance the core loss seriously. This "load" current may be supplied by a separate generator or by the "exciting" generator, but should pass through a transformer with strong insulation between primary and secondary, even if the required ratio of transformation is 1 to 1. This is necessary because the "load" wiring may have a potential against ground equal to the high tension voltage of the transformer under test, and it is easier to insulate against this in a transformer than in a generator. If three transformers are to be tested they are connected as shown in Fig. 5. The secondaries are excited in delta from a three-phase generator, and the primaries are connected in open delta as indicated ,and the load current introduced into the open "corner."

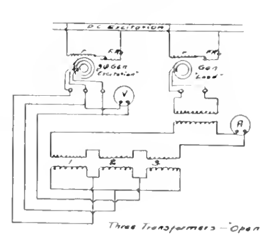
Resistances and temperature should be taken before starting the heat test. The transformers may be put on overload copper loss until the oil temperature shows that heating is about to final value, then the losses are set at normal value and the cooling medium (usually water) introduced, and the amount adjusted according to guarantees. When it is reasonably certain that this is correct a resistance may be taken, and the conditions maintained another hour or so, followed by a final hot resistance. This should be the same as the last one. For calculating temperature rise by resistance, it is best to base calculations on change of primary resistance. "Hot" resistances should, if possible, be taken with same meters and same current settings as the "cold" resistances.

Short approximate formulae are in use for calcula-



Two Transformers — Bucking

Figure 4 Heating Test Connections



Three Transformers — Open Δ

Figure 5 Heating Test Connections

tion of temperature rise by resistance. One of these in use is as follows: –

$$\text{Rise by Res. in C}^\circ = \frac{\text{Res. hot} - \text{Res. cold}}{.0041 \times \text{Res. cold}}$$

After a transformer has slightly cooled down from the heating test it should be given the "high voltage" ground test. This consists in applying from two to three times normal working voltage between primary and grounded (to case and core) secondary, and between secondary and grounded primary.

The testing transformer should be excited from a generator of suitable voltage, so that the generator voltage will be somewhere near its normal value when the high tension testing voltage is correct. This allows the generator to give its proper wave form. This should be as nearly as possible a sine wave. The voltage should be adjusted by means of the generator field rheostats, and never by rheostats in series with the low tension side of the testing transformer, as their presence there changes the wave shape. Testing voltage may be measured by spark gap, by conversion, or by a combination of the two. If the transformer under test be insulated from ground by being set on an insulating platform, the middle point of the testing transformer's high tension winding may be grounded. A section of this winding next to the ground may safely have a tap brought out, suitable for voltmeter readings, containing, say $\frac{1}{1000}$ of the high tension turns between the tap and the ground. This gives a measure of the high tension voltage. The voltmeter readings should be checked by spark gap under actual conditions of test.

The procedure in applying high voltage test to a large transformer, then, is as follows: The testing transformer is connected to the transformer under test, one terminal to primary winding, the other to secondary winding and case. Across these leads is connected the needle gap. These reduce the effective spark gap length by an amount that must be found experimentally. If the testing voltage is, say, 100,000 volts or less, the gap is set at the required length according to A.I.E.E. curve, for fresh needle points. With transformer connected in circuit, the voltage is increased gradually by generator field control and the voltmeter reading carefully watched until the gap first snaps. Voltmeter reading before the "jump" is carefully noted, and the field lowered to zero. Then the gap is opened wide and the voltage gradually brought up till the same voltmeter reading is obtained, held one minute and gradually lowered to zero. It should take at least three minutes to bring voltage from zero to required testing voltage. Sudden changes of voltage should be strictly avoided. For voltage of over 100,000 the procedure is slightly different. The spark gap may be set at $\frac{2}{3}$ testing voltage. Carefully break down this gap, noting voltmeter reading. Having separated the needles, bring up the voltage to $\frac{3}{2}$, the former reading, corrected for calibration of the meter.

After a transformer has stood insulation test it should be run under normal voltage for a sufficient time to make it evident that it has suffered no damage from the test.

Messrs. Longmans, Green & Co., London, Eng., have published a book upon "Radiotelegraphy and Radiotelephony," for students and operators, written by G. A. Fleming, M.A., D.Sc., F.R.S., of the University of London. The book is designed to be a small manual explaining the scientific principles underlying radiotelegraphy in general and to be suitable for the use of students, practical operators and the general reader. It is extensively illustrated, and will prove of much use to those who make a study of this subject.

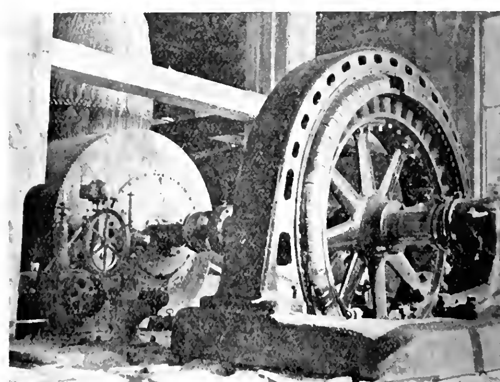
W. C. Edwards & Co.'s Electric Equipment.

The new plant of W. C. Edwards & Co. at New Edinburgh is one of the most complete lumber mills in Canada. It is modern in all respects and in none more so than in its power equipment. The power plant is situated on the lower level of the site in one corner, partly under the flooring mill. Power is supplied from three 1,500 horse-power hydro-turbine generators, two

W. C. Edwards & Co.'s Plant—Interior of Planing Mill.

200 horse-power exciter sets and two 1,000 horse-power steam boilers with dutch ovens for burning the refuse. It is the intention of the company to sell to the city and other manufacturers all their surplus power. All machines used in the plant will be the most modern of their kind. Those in the sash and blind factory will have individual motors belt connected, those in the planing mill will be direct connected to their own individual motors.

The planing mill machinery consists of the following: One McGregor-Gorley forming saw (three saws), one Tower trimmer (four saws), one rip saw (two saws), one McGregor-Gorley timber sizer (four sides), one Berlin No. 89 hard wood floorer, one Connel & Dangler



W. C. Edwards & Co.'s Plant—One of the Turbines and Generators.

60-inch band resaw, two S. A. Woods No. 24 matchers, one double 55 exhaust fan "Stirling." These are direct connected to motors of proper size, the combined motors having 235 horse-power plus 25 per cent. for overload. The sash, door and blind factory is at present being fitted up with 65 machines of varied makes and character. The combined motors will furnish 410 horse-power for this building, plus 25 per cent. for overload. About 400 horse-power motors will be required for the flooring mill.

All motors throughout the entire plant are of the Allis-Chalmers-Bullock type, three-phase, a.c. 60 cycles, 550 volt motors, varying in size from three to seventy-five horse-power. The buildings were erected by the Trussed Concrete Steel Company of Canada, Ltd.

Winnipeg Electrician's Report.

The following interesting report was presented to the Winnipeg City Council by Winnipeg's Chief Electrician, Mr. F. A. Cambridge:—

While south and east recently I looked into several matters affecting my department, which I ask leave to report as follows: Street Lighting.—I investigated two new applications of arc lighting that have recently been brought out, namely, the Luminous Arc Lighting System and the Daniels Boulevard Lighting System. The former is installed in Toledo, Ohio, where some 1,670 lamps of that type are in successful operation. The light is a pure white, and the distribution and diffusion almost perfect. I consider this system to be especially useful on business streets where a brilliantly lighted thoroughfare is desired. The power of the lamp is greater than that of any system I have yet seen, and it appealed to be as being well worth looking into further, with a view to the more adequate lighting of Main Street and Portage Avenue.

The Daniels system was evolved by the superintendent of the Chicago South Park Commission lighting system, and was the outcome of efforts to provide what would not only be an effective lighting system by night, but one that would appeal to the artistic sense by day. The arc lamps are inverted, and are enclosed in a 20-inch opal ball globe mounted on a reinforced concrete post or column of a very pleasing design, in fact the result of a competition instituted by the Park Association and the Chicago Architectural Club. I visited the electric lighting plant of the South Park Commission (which, I may say, is a model one in every sense), and saw a number of lamps in operation. The result is both effective from a lighting standpoint and pleasing in its appearance. As the lamps are only about 12 feet from the ground, the light is well distributed under the trees, without shadows. The opal globe tones down the light so that to parties driving or motoring especially it is free from the objectionable glare of other forms of illuminants. While in Cleveland I visited the works of the company exploiting this system, and saw several types of concrete posts. I also went into the details of the system generally.

I consider this form of illumination would be an ideal one for Broadway and the streets running south to Assiniboine Avenue, which are all very poorly lighted at present. The wiring has, of course, to be carried underground, but as the city cannot continue the present service much longer without installing much higher poles at considerable expense, owing to interference of trees, and as for the same reason it is considered inadvisable to extend the overhead system to light the streets running south from Broadway, I am of the opinion that it will be advisable to make arrangements at an early date for placing underground ducts and cables for the lighting of this district. I would therefore recommend this system to your favorable consideration. It would also be especially suitable for lighting any of the city parks, in some of which it could be installed to great advantage.

Fire Alarm and Police Telegraph Service.—A number of matters were discussed affecting these systems during the convention of the Musicipal Electricians' Association, which was held at Detroit, and which proved of great interest to your Electrician, especially in view of the proposed establishment of a police patrol service in this city. With that in view, I spent some time in Celeveland inspecting a new police telegraph system installed there recently, also one of a different type in St. Paul. I also examined a new system in Toledo. Looking for a suitable design for our proposed iron posts for support of police and fire alarm boxes, the neatest and best post was seen at Toledo, the two boxes being mounted on one post. While in Toronto I enquired into a matter of a special telephone system that they are fitting up in connection with the high pressure fire service, whereby a fire department officer can reach any fire station from telephones mounted in boxes on the streets.

A matter was discussed at the convention which might appear trivial to those not connected with the service, but which is most important, namely, the proposal of the United States Government to change the color of all mail boxes from green to red. This raised unanimous protest; every member being requested to have his own city petition the Government against their proposed action. I would again urge this committee to endeavor to induce the Federal Government to change the color of our local postal boxes, as it would save much confusion and loss of time in sending in alarms by citizens.

The association honored the City of Winnipeg, in that its representative was placed on the Executive Committee, and was also appointed third vice-president of the association. While in Chicago I made a special study of sprinkler alarm systems, and received considerable information thereon. I hope to have a full report on this before you at the next meeting.

Regulation of Electric Wiring.—American cities have made very material progress in the matter of removal of overhead wiring, considerable progress being noted since my last visit east three years ago. I went into the matter with several members of the association, and also went over part of the city of Toledo with the city electrician, who at the time of my visit was enforcing on ordinance affecting that form of construction. In that city immense improvement is noticeable, particularly in the lanes and alleys, which not only removes a source of danger and hindrance to the fire department, but improves safety conditions generally, to say nothing of appearances. It is also noticed that iron or steel trolley poles are in general use in cities, a wooden pole being hardly ever seen.

The important matter of safe wiring in the installation of interior electric work was discussed at length by the association, particularly the moving machine hazard. In this respect and also as to general interior wiring the city of Winnipeg is well up to the standard. The most important recommendation advanced what that of compelling the use of iron conduit for all basements of public and mercantile buildings.

E. J. Coster, local manager of the Bell Telephone Company at Prince Albert, Sask., has received news that the Bell Company are now busy pushing their long distance line forward to Dutch Lake. This is patr of the line to extend from Saskatoon to Prince Albert. Already a number of miles of poles have been erected, and the Bell company are using every effort to complete the work this fall.

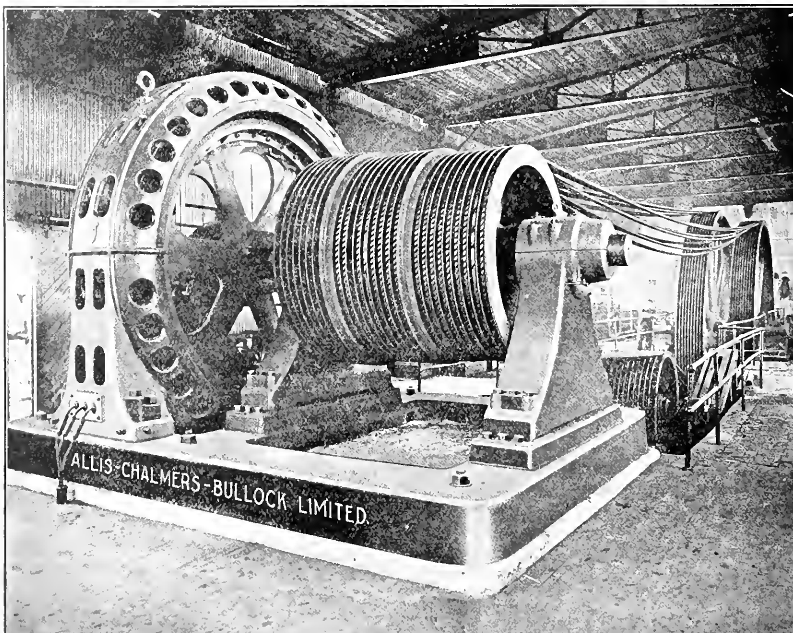
New Electrically Equipped Tin Plate Works

First in the World to be Entirely Diven by Electric Power. Building of Steel, Concrete and Stone.

The works of The Canada Tin Plate and Sheet Steel Company, Limited, at Morrisburg, Ont., are the first of the kind erected in Canada for the production of black and galvanized sheet steel, tin, terne, black and Canada plate. Tin, being proof against ordinary rust, or corrosion by acids, is most useful for culinary purposes, but, as in its pure state it is both soft and expensive, it forms for commercial purposes merely a coating over copper or iron. At Morrisburg the metal plates are rolled to the requisite weight, and then go through a process of immersion in baths of the pure tin. The equipment for hot and cold rolling, pickling, annealing, tinning and galvanizing are all arranged for continuous operation with a minimum of labor.

These tin plate works have the distinction of being the first in the world to be driven entirely by electric power. The current is supplied from the plant owned by the town of Morrisburg. The electrical equipment including induction motors, switchboards, transformers, etc., was built by Allis-Chalmers-Bullock, Limited, of Montreal. The motors are of the wound rotor type and of specially heavy construction in order to give satisfactory operation under working mill conditions.

Figure No. 1 shows a 350 H.P., 3 phase, 60 cycle motor running at 200 R.P.M. directly off the town mains at 2,200 volts and operating the cold roll equipment. Starting torque is provided by switching grid-iron resistances in the rotor windings and gradually cutting out as the motor comes up to speed. The slip rings are shown on the motor shaft on the side opposite the pulley, the connecting cables running beneath the floor to the grids which are not shown in the view. The motor is provided with a step cone pulley grooved for nine 9 x 7, 1¾" cotton ropes. The driven wheels are each 22 ft. in diameter, and the two at present in use weigh 20 tons each and revolve at 45 and 47½ R.P.M. The third will be lighter in weight and revolve at 50 R.P.M. Each wheel is designed to run direct connected 3 stands of 22" cold rolls and the conveyors between them.



Electrically Equipped Tin Plate Works. Fig. 1.

Figure No. 2 shows two motors each 650 H.P. three phase, 60 cycle running at 200 R.P.M. directly off the town mains at 2,200 volts and operating the hot mills. The starting torque is obtained by an arrangement of resistance connected similar to those of the cold roll motor. Twenty-two 1¾" cotton ropes connect each motor with a 30 ft. flywheel which weighs 75 tons. Each of the motors is designed to carry four sets of 26" hot mills. These mills are connected in train direct to the large wheel by means of 18" spindles and loose coupling boxes.

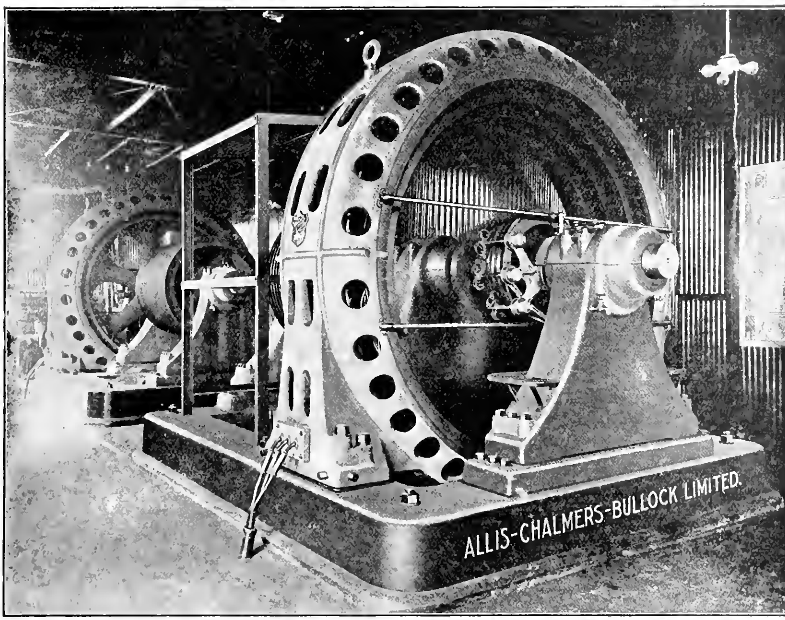
The buildings are of steel, concrete and stone, spacious, well-lighted and ventilated. The plant is of the most improved design and constructed with a view to

economical production. Mr. N. D. Lewis, the general manager together with Messrs. Peacock Bros., engineers, Montreal, designed the lay-out. Mr. Lewis, together with Mr. B. B. Tucker, resident engineer, personally supervised the construction.

It is reported from Nebraska that the Western Union Telegraph Company is making arrangements with telephone companies for the delivery of messages by telephone from the larger towns in the State to places where no telegraph operator is employed. It is expected that the service of this class will be considerably extended as soon as definite arrangements with the telephone companies are made.

One of the many industries in the growing city of Niagara Falls, Ont., is the manufacture of cyanamide. Hundreds of men are now employed in erecting the permanent buildings. The first structure erected measures 150 by 150 feet, being 66 feet in the highest part. Three other buildings have been started, each of which will be 100 feet square. Coke and lime are used in the manufacture of cyanamide by means of an electric furnace, the resulting compound being in turn pulverized and combined in a second electric furnace with nitrogen from the air secured by a special process. The material thus obtained contains 20 per cent. in weight of nitrogen, the balance being the coke and lime compound which serves to bind the nitrogen. This compound is calcium cyanamide, and when sown in the soil it decomposes and dissolves in contact with the soil moisture, is then absorbed through the roots of the plants and becomes a valuable constituent. Three years of actual use upon farms in Europe has proved the value of this substance in connection with the wheat, corn, oats, barley, rye, rice, tobacco, and other crops. Some crops have been doubled by its use. The present plant, which is of 5,000 tons capacity, is only regarded as an introduction of this new industry, as plans are already in preparation for the establishment of a plant of 20,000 tons capacity.

The Pettingell-Andrews Company, Boston, Mass., have issued a catalogue of their ignition specialties, comprising a collection of coils, switches, etc., which they guarantee to give perfect satisfaction. The catalogue contains a number of important and interesting facts about the J. & B. spark coils and a number of other specialties handled by this company. It is attractively illustrated and interestingly prepared.



Electrically Equipped Tin Plate Works. Fig 2.

The Stuart-Howland Co., electrical spplies and specialties, Boston, Mass., have leased the adjoining building, Nos. 1, 2 and 3 Winthrop Square, and 12 to 36 Otis Street, and have recently moved their store and office to that address. This gives them greatly increased space, and as there are about 13,000 feet on each floor, with over 326 feet of street frontage, the premises are unusually light and admirably suited for their purpose, while the large floor areas enable them to handle goods with greater economy. The company have gone to a large expense in fitting up each department of their business, and their facilities, we believe, are now unsurpassed by any electrical supply house in the United States. They have recently acquired several valuable agencies, have largely increased their stock, and report that business is considerably in advance of that of last year.

TELEPHONE TOPICS

Election Returns in Manitoba.

W. H. Hayes, the Manitoba telephone commissioner, made the following arrangements for distributing the returns over the telephone wires:

A special staff of operators were set aside and supplied with the list of all the constituencies and their respective candidates. Anyone calling central and asking for election returns was plugged through to this special staff, who gave the information that the newspapers were willing to give out. In case a party called up and, asking for one of the papers, found all the lines busy, central would ask if it was election returns that they wanted, and if so they were connected with the special operators The regular night staff of operators was increased so as to give the best service possible. People out in the country were able to utilize the telephone as a means of obtaining election news, as the different exchanges throughout the province remained open until the returns were in. A party using the long distance line paid toll as in any ordinary case, but had this convenience that he did not have to call the newspaper offices, but by being connected with the sepcial operators was given just as reliable returns as he could obtain elsewhere and in quicker time.

The Telephone for Train Dispatching.

Mr. J. Kent, manager of the C. P. R. telegraphs, who has just returned to Montreal from a trip to Winnipeg, states that telephone lines are now being strung on the telegraph poles with a view to establishing a complete telephone service between Montreal and Winnipeg for train dispatching. A circuit has already been established from Montreal to North Bay and from North Bay to Whitemouth. By the time that the operating department takes over the new double-track between Fort William and Winnipeg—which will be very shortly—the telephone circuit with Winnipeg will be ready. The telephone, Mr. Kent says, has shown itself to be admirably adapted for dispatching trains, and already in the United States over seven thousand miles if railway are controlled by it. The C. P. R. had already utilized the telephone very largely for this work, and besides, all passenger and freight trains are now provided with a telegraph apparatus, which enables a train at once to communicate with the nearest operator in the event of an accident.

Saskatchewan's Telephone Arrangements.

The Saskatchewan Government's telephone plans make the following arrangements for rural companies:

Rural telephone companies are given power to enter into agreements for the interchange of service with any other telephone company, the Commissioner being empowered to enforce an agreement, if necessary.

The books and accounts of all rural companies are subject to the inspection of the Commissioner, or his agents. Said books and accounts to be closed and balanced on the 31st of December in each year, and in case, after providing for all outstanding liabilities there remains a balance of cash on hand, the company may declare a dividend not exceeding eight per cent. on the paid-up capital. Any surplus remaining after the payment of such dividend shall be employed in enlarging, extending or adding to the company's system.

No company except as provided for by the act shall be organized, incorporated or registered under the laws of the Province of Saskatchewan; and all companies organized under the provisions of the act shall be exempt from all assessments, rates or taxes.

The capital of any one company shall not exceed \$150 per pole mile of the line to be constructed by the company, but with the consent of the Commissioner, the capital may be increased from time to time for the purpose of enabling the company to add to, enlarge or extend its system. The capital shall be divided into equal shares of \$25 each, and 20 is the maximum number a subscriber can hold. Before construction is begun, the company must have paid up an amount equal to \$20 a share. A rural company cannot refuse admission to anyone desiring to join and install an instrument, provided such person lives in the community where the company operates, and that such connection does not exceed a cost of \$50.

Manager K. J. Dunstan, of the Bell Telephone Co., at Toronto, notified the Board of Control recently that the city must remove all fire alarm wires attached to the company's poles. Secretary McGowan, of the Fire Department, was asked to try to arrange the matter with the company. Recently one of the company's linemen sustained severe injuries by coming in contact with one of the city fire alarm wires attached to one of the company's poles on Huron Street, which was crossed with an electric light wire, and thus charged with a high voltage.

Fall Inspection and Repairs.

Damage to telephone lines may be anticipated in a large number of districts every winter, says "Telephony." The expense incurred in taking care of sections of the plant destroyed during sleet storms is in itself a serious thing. But the resultant break-down of the service, and loss of poles and wire, also tends to create in the minds of uninformed observers an impression that a telephone plant is a fragile, cheap thing which cannot stand hard knocks. And this, in not a few cases, has been known to make the timid ones a bit wary of telephone investments.

Telephone men know that really extensive damage to any single plant is an exceptional occurrence, and is almost invariably due to the existence of construction which is not up to standard. But that explanation is rather unsatisfactory after the damage is done. So we see each year as the winter months approach that an increasing number of companies are giving very careful attention to the task of putting their open wire plant in shape to withstand the severe strains of the winter. A few days' work by a gang of men, under the supervision of a person competent to figure out the real necessities of the situation, will be sufficient to pull up slack cables, guy corner poles, or those exposed to strong transverse winds, replace weak cross-arms, and, in fact, reduce the number of weak spots to so low a

figure as to make the probability of damage very small indeed. Of course, the modern tendency to employ extensive underground and aerial cable distribution in cities and towns is yearly reducing the amount of winter damage. But, in the average plant, there is room for much improvement in existing pole line construction, and the systems in which the fall bracing-up is most thoroughly undertaken are usually able to show a better surplus at the end of the year than their neighbors who take chances.

Battery Call System for Windsor, N. S.

A battery call system has been installed in the town of Windsor, N.S., in a new office building specially erected for the purpose. The equipment in the town has been rebuilt with new poles, cables and terminals to provide metallic circuits for all subscribers, who sign contracts for the improved service. Two 100 pair underground cables are run out from the office to a Gal Two Electrical News.
pole on the street, thence run in opposite directions in 100 pair aerial cables. The large cables gradually taper down to 50 and 25 pair cables at the thinly-settled portions of the town. The open wires now in use, with the exception of the long distance lines, will be removed from the heavily loaded poles, and for the purpose of maintaining long distance lines at a high transmission efficiency, the policy of the company is to keep these lines in open wire as much as possible, since they are few in number relatively, and pass through many towns en route to their destination. At the present time Windsor is coneeted to Halifax by two metallic circuits, one copper and one iron; connections can also be had with Truro and all points east in the Province and New Brunswick, by means of two metallic circuits to Truro, one copper and one iron. In the other direction there are three circuits to Hantsport, two running through the Valley, one copper and one iron, to Digby, where connections can be made to Yarmouth.

Bolton Company's Plans.

The recently incorporated Bolton Telephone Company, Limited, of Bolton, Ont., has a charter covering the townships of Albion, Chinquacousy, Gore of Toronto, and the village of Bolton, in the County of Peel, and the townships of Adjala and Tecumseh, in the County of Simcoe. The company have bought out all the Bell lines in these townships, and are centralizing their service at Bolton, where they have a joint centre. At present they have 140 telephones in place and about 30 miles of line have been built. The capital stock of the company is $20,000, which is divided into shares of $25 each. The officers of the company are: A. H. McFall, president; Robert Smith, secretary-treasurer; W. A. Caldwell, electrician; F. N. Leavens, local office manager, and H. A. Rutherford, director.

The long distance line from Regina, Sask., to Antler, a distance of 200 miles, will probably be completed this fall. The gang constructing the line are averaging over three miles per day, and have covered as much as five miles in a day. For the building of this line 7,200 poles have been ordered and 104,800 miles of wire. This is the first long distance line to be built by the Saskatchewan government.

The capital stock of the Russell Telephone Company, of Russell, Man., has been increased from $5,000 to $25,000.

Central and Exchange Notes.

Work has been started on the installation of a telephone system at Swift Current, Sask.

A movement is on foot at Rossland, B.C., to organize an Independent telephone company.

The Leeds Rural Telephone Company are extending their lines from Seeley's Bay into Pittsburg.

A 400 line common battery cable telephone plant will be installed at Wolseley, Sask.

The Milestone-North East Telephone Company has been incorporated at Milestone, Sask., with a capital of $5,000.

The Gary-Milestone Telephone Company has also been incorporated at Milestone with a capital of $5,000.

Tenders for the construction of a rural telephone line at Killarney, Man., were taken until October 15th by J. M. Baldwin, secretary-treasurer.

The telephone line extending from Barss Corner, Lunenburg, N.S., through Maplewood and Parkdale, is nearing completion.

The Waterford, Ont., Council have passed a by-law granting a franchise to the Norfolk Telephone Company.

Tenders were received by J. M. Baldwin, secretary-treasurer, until October 12th, for the construction of a rural telephone line running from Killarney, Man.

Plans for the new telephone exchange at Portage la Prairie, Man., have nearly been completed by S. Hooper, Provincial Architect, Winnipeg.

Plans are being made to organize a local telephone company to build a system in the town of Dundurn, Sask., with rural lines to adjacent districts. E. J. Meilicke is interested.

The Alberta Provincial Government has commenced the erection of a new telephone line from Red Deer to Pine Lake, a distance of about 25 miles. A second line is being built to Hill End.

Engineer Guibault is installing a system of 200 line capacity at Swift Current, Sask., and some 120 miles of rural line, averaging one subscriber to the mile.

The Cranbrook Electric Light, Power and Telephone Company of Cranbrook, B.C., has received a contract to install a telephone system in the municipality of Fernie.

The County Council has granted a franchise to F. Reinke and C. Shaver to erect a telephone line between Ancaster, Ont., and Waterdown, Ont., a distance of about 21 miles. The cost of the system is estimated at about $10,000.

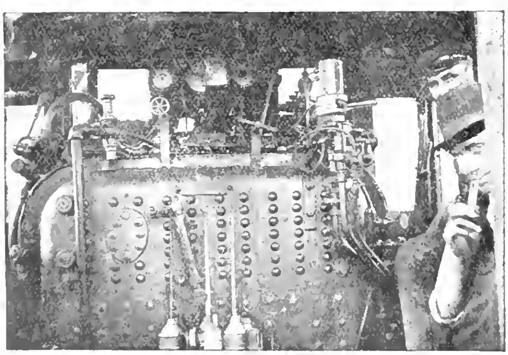
The telephone system being installed at Virden, Man., in the municipality of Wallace will be connected with the government system there and at Elkhorn. The municipality will be responsible for all long distance business originating on its lines. F. C. Menlove is secretary-treasurer.

A telephone company has been formed in Cranbrook, B.C., to be known as the Kootenay Telephone Company, Limited, which will be capitalized at $200,000. It has purchased the Cranbrook Telephone Company's system and will operate within the boundaries of British Columbia.

An Automatic Train Controller.

The Price Automatic Train Controlling System, which is the invention of Mr. H. W. Price, of the Electrical Engineering department of the University of Toronto, is a unique system whereby collisions are prevented between railway trains by means of an automatic electrical system. In the working out of the system two principal parts have been evolved. The first is an equipment on the track at intervals throughout the sections requiring protection, the duty of which is to work automatically for the control of trains in case of their undue proximity. The second is an equipment on each locomotive, the duty of which is to slow down or stop a train automatically when the equipment has been started into operation by the track equipment.

The rails of track equipped with this system are divided into blocks of any desired length by insulated rail joints. At the end of each block is located a post, carrying a relay box, which contains a track relay and line relays; also at this place there is a chute, containing a track battery and a line battery. The track battery at one end of each block normally energizes, through the rails of the block section, the track relay at the other end of the block. A train anywhere in a block between a track battery and its relay will short circuit the track relay and cause it to release its armature. Each train has a like effect on the track relay of the block occupied. Each track relay armature when caused to drop, opens contacts in the line circuits, which results in establishing permissive connections at the relay posts, ahead of the moving train, provided no other train is ahead and nearer than two clear blocks. Thus a train on a clear track, or running at a safe distance, away from other trains, is permitted to pass all relay posts without having its train-controlling mechanism in the engine put into operation. If, however, two trains be running so as to leave only two clear blocks between them, the track relays de-energized by the two trains open the line circuits in such a manner that all permissive connections between the trains are broken, and trains then passing the relay posts between them are automatically brought under control.



Brake Controller Mounted on the Engineer's Brake Valve.

In general, one train on a single track equipment is free to travel in either direction. Two trains can travel in the same direction on one track, provided they remain apart at least one and a half to two miles, according to the length of blocks chosen. Should the following train attempt to reduce the distance between them, it would be automatically braked at the next relay post ahead of it, while the leading train would not be interfered with. If the two trains were approaching each other so as to be in danger of head-on collision, both would be stopped.

The engine equipment required is not complicated. A trip coil in a "signal receiver" in the cab of the engine is normally energized by a small current, which flows continuously, except when interrupted by the presence of another train ahead. When de-energized, this coil drops its armature, and as a result the "receiver" turns air at 90 pounds per square in. (from main drum supplying the air brakes) into a "brake valve controller," which then forcibly moves the engineer's brake valve handle to service position and automatically holds it there an adjustable interval made long enough to bring the train to caution speed, or a full stop, if so desired, by suitable reduction of train line pressure. After the interval of brake valve control has expired, the receiver exhausts the air from the brake valve controller, and automatically leaves everything in the engine equipment ready for future duty. The driver cannot prevent the setting of brakes, but can, if he wishes, release them immediately after the air has been exhausted from the controller. The brakes are not automatically released. The engineer must release them. He is also free to move the handle on to emergency position at any time.

A Signal Box Installed on the Intercolonial Railway near Moncton, N. B.

It is claimed for this system that the equipment is much cheaper than that required for visual systems, and that the maintenance cost is much less, as the battery equipment is much smaller, and there are no lamps to require daily attention. The system is owned and controlled by the Universal Signal Co., Ltd., of Toronto.

The Lincoln Electric Light and Power Co. have secured the contract from the city of St. Catharines, Ont., for light at the following prices for a period of seven years, commencing September 1, 1908, for the sum of $50 per arc lamp per year. The city will also agree to use 100 arc lamps by December 31, 1909. The St. Catharines Gas Co. put in a tender as follows: 325 gas lamps for $26 per lamp, 9 gas arcs for $55 per lamp. The small lamps to burn on an all-night schedule, the 9 gas arcs to burn full until midnight; one mantle after midnight. The Light Committee in reporting submitted a comparative statement as follows:—325 gas lamps at $26, $8,450; 9 gas arc lamps at $55, $495; total, $8,945. Lincoln Electric Light and Power Co.'s proposition, under which the present gas lamps, together with at least 81 electric arc lamps would be used:—125 gas lamps at $28, $3,500; 11 gas lamps at $27.50, $302.50; 81 electric arc lamps at $50, $4,050; total, $7,852.50. The latter proposition showed a saving of $1,092.50.

QUESTIONS AND ANSWERS

GENERAL RULES TO BE OBSERVED BY CORRESPONDENTS:

1. **All enquiries will be answered in the order received, unless special circumstances warrant other action.**
2. **Questions to be answered in any specified issue, should be in our hands by the close of the month preceding publication.**
3. **Questions should be confined to subjects of general interest. Those pertaining to the relative value of different makes of apparatus, or which for intelligent treatment, should be placed in the hands of a consulting engineer, cannot be considered in this department.**
4. **To avoid trouble and unnecessary delay, correspondents should state their questions clearly, so that there can be no possiole doubt as to the information required.**
5. **In all cases the names of our correspondents will be treated confidentially.**

Question No. 1.—Would you please explain to me the meaning of Z connection?

Answer.—The Z connection is a method of connection sometimes used, namely, when three current transformers are used on a three phase line, one in each conductor, to operate a two coil relay. Under such conditions ordinary delta connections would result in an overload or short circuit between phases sending more current through the relay than would come from a ground on one conductor. In other words, the tripping point would be different, depending on whether the overload was flowing in one conductor or in two, and as this is not desirable, means are naturally sought to get away from it. The required remedy is found by reversing the secondary of one transformer, and this scheme of wiring, being simply the delta with one secondary reversed, is called the Z connection.

It is distinguished from other transformer connections, such as the delta, the T, and the V, in being applicable to series transformers only, or rather the necessity arises for it only in connection with series transformer work, whereas all the others are used on light and power transformers as well. It should be noted that the Z connection will not give the necessary phase relations between current and voltage to allow of the operation of wattmeters.

Question No. 2.—When synchronizing two three-phase generators, why is it necessary to synchronize only on one phase? I would think that you would have to make sure that all the three phases were right.

Answer.—If the three phases in the two machines follow each other in the same way with relation to the manner in which the leads have been brought to the bus-bars, all you need to do is to synchronize on one pair of phases only, as if they are brought into synchronism with each other, it is obvious that the other phases that bear a corresponding relation to them must also then be in phase with each other. In order to make sure that your leads are so arranged as to connect corresponding phases, you must either put temporary synchronizing apparatus onto an extra pair of phases when you are first throwing the machines together, or you may try them at a reduced voltage, when a wrong connection will not do so much harm, and see whether or no any of your leads have to be interchanged. You, of course, understand that once the wiring is made correct, and assuming that nothing is altered in it or the windings of the generators, the synchronizing of any two phases will mean that the others will also be correct, which is the reason that, except when first starting up, there is no need for synchronizing apparatus on any but one phase in each machine.

Question No. 3.—Would you please tell me the meaning of the term "apparent efficiency"?

Answer.—Apparent efficiency is an expression used in connection with alternating current apparatus to indicate the relation between the volt ampere input and the actual output in horsepower, or true watts. The term comes up most usually in connection with induction motors, and then represents the relation between the volt-amperes taken by the motor from the circuit and the horsepower which it delivers at its pulley; for example, a motor consuming 1,492 volt-amperes and delivering 1 horsepower, equal to 746 watts, would have an apparent efficiency of $\frac{746}{1492} = 50\%$. This efficiency is called apparent because it is not the true or real efficiency, which latter is the relation between the real power consumed and the real power given out. In the foregoing example, taking into account the power factor, which is, say 70%, the real power input would be $\frac{70}{100}$ of 1492, = 1044 watts. Then the real efficiency, or, as it is usually called, simply the efficiency, is $\frac{746}{1044} = 71\frac{1}{2}\%$.

Question No. 4.—Is there any objection, when running a car equipped with series-parallel controllers, to shutting off part way only, to the series position, instead of shutting right off and then building up again to the series stop?

Answer.—There is no objection that we know of, though in view of the fact that nearly all street railways train their motormen to shut right off, and then build up part way again, there might be some special reason for the practice. If so, we would be glad to have any of our readers write us on the point. The writer has always advocated shutting off part way only as a means of saving considerable wear on the controllers, also because it reduces the jerking on the motors, thus saving wear and tear on them, particularly on the gears and pinions. Besides it tends to smooth out some of the variations in the load on the power house.

The Central Heat, Light and Power Company are considerably increasing the power equipment of their plant at St. Peter Street, Montreal. They have hitherto used three Belliss engines, totalling about 800 horsepower. Messrs. Laurie & Lamb, consulting engineers, Montreal, are now installing for them another Belliss engine of 430 horsepower, with a 300 k.w. General Electric generator. The additions to the plant are being made under the supervision of Messrs. Ross & Holgate, Montreal.

Work has been resumed on the development of the big water-power at Fort Francis, Ont., for the Backus-Brooks Lumber Company. The development on the Canadian side of the river, including the erection of paper and pulp mills, will be rushed ahead and concluded before any extensive work is done on the American side. The contract for the completion of the dam and building the pulp mill has been let to J. J. White & Company, of New York. Their general superintendent and chief engineer, Mr. P. F. Richardson, of New York, is now on the ground, accompanied by Mr. H. P. Carter, assistant superintendent.

Current News and Notes

The Ontario Power Company, Niagara Falls, Ont., are preparing to add two additional units to their power house.

Strathcona City Council will extend the electric power system to the Alberta Farmer's Association's grain-cleaning plant.

A 90 horsepower producer gas power plant has been installed in the Deseronto waterworks. The pump is direct connected to the engine.

The Town Council of Oshawa, Ont., is making application to Parliament to construct and operate an electric light and power plant.

The Water Commissioners of Lindsay have decided to install an electric pump instead of a steam one for the pumping of its water supply.

The ratepayers of Revelstoke, B.C., voted in favor of raising $10,000 by the sale of debentures to complete the auxiliary power and light plant.

The Light, Heat & Power Co., of Lindsay, offer to install electric energy in the waterworks pumping house at a saving of $500 annually over steam.

The first street cars for the municipal system at Edmonton, Alta., have arrived. They were manufactured at Ottawa, Ont., by the Ottawa Car Company.

In connection with the Galt Electrical Manufacturing Company, the Lyons Electrical Company, of Brantford, are installing a large generator at Brantford.

The Ontario Power Company is negotiating with the Westinghouse Company, of Pittsburg, Pa., for the purchase of a generator and switchboard to cost $70,000.

The Marconi Wireless Telegraph Co. have recently placed an order with the Robb Eng. Co. for a 75 h.p. Robb-Armstrong engine for their Glace Bay station.

The Town Council of Orillia have decided to heat the power house at the Ragged Rapids by electricity. Electric heaters to cost about $1,000 will be installed.

The authorities of Glace Bay, N.S., are installing 400 meters in connection with the municipal electric light plant, and are also adding about three miles of transmission lines to the system.

Application is being made for the incorporation of a company to be known as the Belleville Radial Railroad Company to operate an electric railway in and around the city of Belleville, Ont.

The Galetta Electric Power and Milling Company have everything almost completed at their power station in Galetta, and expect to soon commence the work of erecting the poles for the line into Arnprior.

The Yukon Basin Gold Dredging Company has secured a waterpower at the head of the Stewart River which is estimated to yield 83,700 horse-power. The power will be used to operate the company's dredges.

Arrangements are now being made to put a by-law before the ratepayers of Fernie, B.C., to provide sufficient money to rebuild and operate the Crow's Nest Electric Light and Power Company's system as a municipal enterprise.

The ratepayers of Port Arthur, Ont., have voted in favor of spending $97,000 for power development, $32,000 for electric lighting extensions, $7,000 for street railway work and $25,000 for extensions to the telephone system. J. J. Carrick may be addresed.

The Vancouver Traction Company, which has placed three miles of line in operation in Vancouver, has announced that it will immediately build 15 miles of road running north-east from the city, connecting several towns and tapping a rich farming district.

The City Council of St. Boniface, Man., is preparing by-laws to provide for the establishment of municipal gas and electric light and power plants. At present these commodities are supplied by the Winnipeg Electric Company of Winnipeg. Address Theodore Bertrand, mayor.

Lieutenant Jennet, in charge of government wireless telegraph stations in Alaska, has returned from the North. He reports that all the wireless stations are now open for commercial business. There are stations at Circle, Eagle, Fairbanks, Gibbon and Nome, and the system seems a marked success.

In order to economize its power the British Columbia Electric Street Railroad Company has been obliged to shut off all power for lighting purposes from 4 a.m. until dusk. The shortage of power is due to low water at the power plant at Coldstream, but arrangements are now being made for the construction of an auxiliary plant.

It is stated that another company will make a bid for supplying light to the city of Montreal. The company in question are the Electric Service Company, and although nothing definite has as yet transpired, the terms to be offered are said to be equal to those of the old contract of the Montreal Light, Heat and Power Company.

The Dufferin Light and Power Company has been organized to generate power near Horning's Mills, on a branch of the Nottawasaga River. The intention is to distribute electric energy to Orangeville, Shelburne, Dundalk, Grand Valley, etc. The company have authorized Messrs. Smith, Kerry & Chase, consulting engineers, Toronto, to make designs, plans, etc.

Interesting complications are expected in the street railway situation in Port Arthur and Fort William. The new joint board of members from both cities sent notices to all employees that their services would not be required after November 1st, when a new secretary-treasurer and a new manager would take charge. In the meantime the Port Arthur commissioners, who have been operating the line, have issued instructions to the employees of the system to take orders from no one but themselves. Hence in November it appears there will be two sets of officials and employees for one line.

Returns of the value of electrical exports from the United States for August possess an element of encouragement in that they are 15 per cent. larger than the corresponding figures for July. Still they are much less than the aggregate for August, 1907. As usual, the United Kingdom and the British colonies lead as the best customers for American electrical manufactures. British North America took $285,136 worth and the United Kingdom $166,494. Including British Australasia, British Africa and British East Indies, the total absorbed by the British Empire is $509,839, or nearly 50 per cent. of the entire electrical exports of this country for the month. Mexico is the third best individual customer, with $113,487; Brazil comes fourth, taking $102,033 worth, and Japan is fifth, with

a record of $75,317. The total valuation of the electrical exports for August, 1908, is $1,101,158.

The Canadian Westinghouse Co., Ltd., Hamilton, Ont., have issued a new circular, No. 1138, describing their type EM direct current motors, constant, varying, and adjustable speed. These motors are designed to meet a growing demand for large power units to operate on direct current circuits. Among the strong arguments in favor of these electric motors are their flexible characteristics and their easy and perfect control. The company have also issued a special publication, No. 7061, dealing with electric locomotives, mining and industrial, as produced by the Baldwin Locomotive Works, Philadelphia, and the Canadian Westinghouse Co. These electric locomotives furnish a convenient and economical means of haulage, which has become a recognized factor in mining and industrial work. The catalogue deals especially with locomotive of this class. Large electric locomotives for passenger and freight service on railways are to be described in a separate publication.

Boston capital has become interested in modernizing the city of Twillingate, Newfoundland, and as the initial step will establish a plant for electric light and power. This will be the third plant of the kind in Newfoundland. Conditions at Twillingate are peculiar, for at the present time the only light is furnished by kerosene oil, sold at 25 to 35 cents a gallon. There is no gas and no likelihood of ever having it.

The city has a population of above 11,000 within a radius of four miles, and the plant will start with about 6,000 lights, including 500 street lights. The charter of the Twillingate company is direct from the government and covers the entire district, which embraces an area of about 40 square miles and contains a population of over 72,000.

The plant will consist of two units—250-kilowatt steam turbines—it not being considered wise to depend upon the waterpower at hand, in view of the recent experience of the St. John's company. The plant is being installed under the supervision of Mr. Frederick S. Palmer, of Boston, who is president of the company, and who has associated with him several well-known Boston and Newfoundland financiers.

As a result of the increase in competition in Europe, due to the erection of aluminum works by companies outside of the international aluminum syndicate, the latter was abolished October 1. The price of aluminum, which has been quite low in Europe and for some time past, has now been still further reduced and to such an extent that there is only a slight price difference between copper and aluminum. The London quotations of October 9 were £64.5 to £65 per ton for electrolytic copper and £70 to £75 per ton for aluminum. This is equivalent to 16 cents per pound.

Mr. A. H. W. Joyner, of Toronto, agent for a number of United States manufacturers of electrical specialties, has recently moved his office to more commodious quarters, consisting of the first floor of No. 6 Wellington street east. Mr. Joyner took over the principal agencies formerly controlled by the firm of Joyner-Greene which recently dissolved partnership. There is every promise of a successful career ahead of the new enterprise, as Mr. Joyner has not only a good business training, but is an engineer of considerable experience, a fact which is evident from his having been the Boston Edison Company's electrical engineer for over six years. Until recently he also held an important engineering position with the Stone & Webster Engineering Corporation. Mr. Joyner is handling the central and western territory for Weston instruments, and is also the agent for condit circuit breakers, D. & W. fuse apparatus, Helios arc lamps, Anderson railway line material, besides some good specialties in contractors' supplies. He is in a position to figure on complete switchboards and practically every requisite for power and lighting systems, including transformers, porcelain insulators, arc lamp and brush carbons.

A consignment of Berry, Skinner & Company's patent Fool-proof Switch Gear, and Berry-Siemens Motor Starting Panels, have arrived and are on view at the offices of J. F. B. Vandeleur, 3 Dineen Building, Toronto.

The recent period of trade depression did not affect the Midland Electric Company, of Montreal, to any extent, as their business has grown so much that they have found it necessary to obtain increased capital. They have consequently taken out letters patent of incorporation and sold their business to the new company, the Midland Electric Co., Limited. Mr. J. A. Jacobs, of Cobalt fame, is president of the new company, the other officers being Mr. A. M. Reaper, secretary-treasurer; Mr. Frank Goodwyn of the old company, vice-president and managing director; Mr. A. L. Woolf, one of the old partners, is also on the Board of Directors.

This move has been largely necessitated by the demand for the Kolloid Wolfram lamp, which has demonstrated by practical use that it is a thoroughly commercial metallic filament lamp. Notwithstanding the provisions which the company made to enable them to carry substantial stocks of all candle powers, etc., on hand, they have had difficulty in keeping up with their orders, although they have quadrupled their import orders. After exhaustive tests of metallic filaments the leading light, heat and power companies and large users have adopted the Kolloid Wolfram lamp. The future before this young but progressive firm is an exceedingly bright one. The head office remains as heretofore at 119-121 Youville Square, Montreal.

The Canadian General Electric Co., Limited, and the Canada Foundry Co., Limited, have moved into their new quarters at the corner of King and Simcoe Streets. The purchasing departments of these companies and the sales department of the Canada Foundry Co. will in future be located in the new building.

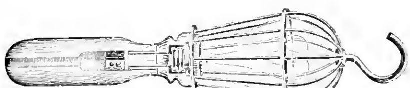
MOONLIGHT SCHEDULE FOR DECEMBER.

(Courtesy of the National Carbon Company, Cleveland, Ohio.)

Date.	Light.	Date.	Extinguish.	No. of Hours
Dec. 1	11 20	Dec. 2	6 20	7 00
3	0 30	3	6 20	5 50
4	1 40	4	6 20	4 40
5	2 50	5	6 20	3 30
6	4 00	6	6 30	2 30
7	No Light	7	No Light	
8	" "	8	" "	
9	5 00	9	7 40	2 40
10	5 00	10	8 40	3 40
11	5 00	11	9 30	4 30
12	5 00	12	10 30	5 30
13	5 00	13	11 30	6 30
14	5 00	15	0 30	7 30
15	5 00	16	1 30	8 30
16	5 00	7	2 30	9 30
17	5 00	18	3 30	10 30
18	5 00	19	4 30	11 30
19	5 10	20	5 40	12 30
20	5 10	21	6 40	13 30
21	5 10	22	6 40	13 30
22	5 10	23	6 40	13 30
23	5 10	24	6 40	13 30
24	5 10	25	6 40	13 30
25	5 10	26	6 40	13 30
26	5 10	27	6 40	13 30
27	5 10	28	6 40	13 30
28	5 10	29	6 40	13 30
29	5 10	30	6 40	13 30
30	5 10	31	6 40	13 30
31	5 10	Jan. 1	6 40	13 30
		Total	....	268 20

A Safe Hand Lamp.

With the increasing use of electricity, a number of accidents, some of them fatal, have from time to time resulted from poorly constructed or imperfectly insulated apparatus, and now that hand lamps are becoming so generally used it is essential that any possibility of danger from such causes should be strictly avoided in these articles. Much attention is, therefore, being paid to the construction of portable lamps, and the R. E. T. Pringle Company, Montreal, are manufacturing a lamp guard which possesses some novel features, entirely obviating all danger from imperfect insulation. It will be noted from the illustration given that the handle of the lamp is bored out to receive the socket, thus preventing any danger of the live parts coming into contact with the metal cage. Another notable feature is the accessibility of the lamp. The metal cage is constructed in two halves with a flange joint, the top half being held in position by three screws working in slots. By simply loosening the screws, and giving the top half of the cage a slight turn, it can readily be removed. Another good point is that the metal supporting hook is at the cage end of the guard, leaving the flexible wire free from any metallic contact at the other end. The hook is also in the most convenient place for hanging.



Pringle Lamp Cut.

Cobourg's Lighting Rates.

A by-law has been passed by the town council of Cobourg, Ont., authorizing the clerk to sign a renewal contract with the Cobourg Utilities Corporation for the supply of water and light to the town. The contract for the supply of water is the same as the former one, but the light contract is greatly in favor of the town as a corporation, and also of private citizens. By the new terms the town gets an all-night service, instead of up to 12 o'clock, and a reduction of $10 in each arc light, making a total of $280 on the arc lights. On the incandescent street lights there is a reduction of 25 per cent., or a total of $80 on the 16 lights. To private citizens there is a reduction of 33 1-3 per cent. The town has the right to buy out the company at any time, and after five years, if it is considered that the cost of light is excessive, on account of any progress that may be made in electrical development, the town can call upon the Government arbitrators to determine the price.

The official Gazette of Ontario contains an announcement of an expected change in the charter of the Electrical Development Company of Toronto. The 5 per cent. dividend is to be made 6 per cent. cumulative. The right of the company to redeem the preferred stock at 110 and accrued dividend is cancelled.

The City Electrical Supply Company has been formed at Wetaskiwin, Alta., by N. D. Farris and R. C. Talbot, entering into partnership. The company will handle a full line of everything required in the electrical line.

Industrial and Business Notes.

The new agreement entered into by the city of Chatham, Ont., with the Colonial Engineering Company, of Montreal, Que., calls for a proper dynamo instead of the present second-hand 50-light dynamo installed by the Colonial Engineering Company. All the other equipement put in by the company was accepted, and the company were asked to pay the costs of any repairs, for one year, if the said repairs be caused by defective installation.

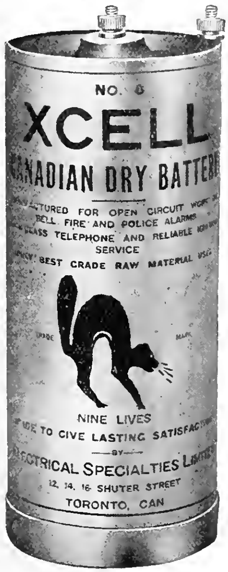
The Niagara Falls Electrical Transmission Company has transferred all its rights, titles and franchises to the Buffalo, Lockport & Rochester Railway Company, which in turn has contracted with the Niagara, Lockport & Ontario Power Company for supplying electricity for the new electric road, which was recently opened to the public. This deal eliminates the competition on Niagara Falls power, which has been anticipated in the section through which the Buffalo, Lockport & Rochester line is to operate.

The Universal Signal Co., Ltd., Norwich Union Building, 12 and 14 Wellington St., E., Toronto, have issued a booklet descriptive of the Price system of automatic train stopping and controlling for railways. The booklet is published by John A. Street & Co., Ltd., Toronto, brokers for the company. This system is described in detail elsewhere in this issue. It should prove extremely interesting to railroad companies, inasmuch as it offers an effective system for preventing collisions of all kinds. The booklet is handsomely published on art paper, and contains a number of attractive illustrations.

The Devoe Electric Switch Co., 157 Craig Street West, Montreal, have issued catalogue No. 4 describing their high grade switches, panel boards, and switchboards. This firm recently made a number of large switchboard installations in new public buildings and factories in Montreal and vicinity.

Orillia's municipal power plant is now completed by the finishing of the new dam at Ragged Rapids.

INTERESTING FACTS



for

JOBBERS and DEALERS

One Jobbing Firm in Montreal took up our X CELLS this Spring, the first order being dated April 10th, 1908. Up to August 10th, 1908, they have sold

12,736 X Cells,

making in FOUR MONTHS, as they gladly admit, TWICE AS MUCH PROFIT ON X CELLS as they have made on imported Batteries during TWELVE MONTHS in 1907, although they handled during 1907

31,075 imported Dry Cells.

This statement should convince you, but it is not surprising, for our

X CELLS
Are Guaranteed

And they Certainly Have

NINE LIVES

We ship FRESH GOODS on date the order is received. When in Toronto inspect our up-to-date plant.

Electrical Specialties, Limited

12-14-16 Shuter Street - - Toronto

New Weston Eclipse Direct Current Switchboard Ammeters, Milli-Ammeters and Voltmeters

are of the **"soft iron"** or **Electro-magnetic** type, but they possess so many **novel** and **valuable characteristics** as to practically constitute a **new type of instrument.**

Their **cost is exceedingly low,** but they are **remarkably accurate, well made and nicely finished** instruments, and are admirably adapted for general use **in small plants, the cost of which is frequently an important consideration.**

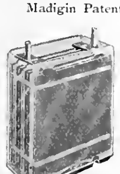
Correspondence concerning these new Weston instruments is solicited by the

Weston Electrical Instrument Co.

Waverly Park, Newark, N.J., U. S. A.

New York Office: **74 Cortlandt St.**

"Vulcan Accumulator"
Madigin Patents



Made in Canada

Established 1898

There are more than

SIX THOUSAND CELLS of

Vulcan Storage Batteries

Used in Canada To-day

TWO YEARS' GUARANTEE

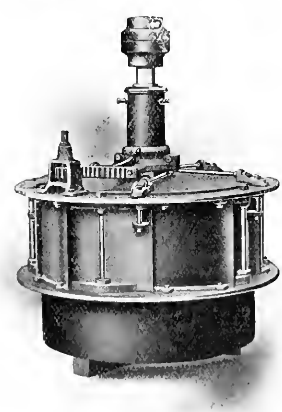
Bulletins on Request

The
Croftan Storage Battery Co.

423-425 West Queen St. - TORONTO, CAN.

Montreal and East: JOHN FORMAN
Winnipeg: GASOLINE ENGINE SUPPLY CO.
Vancouver and West: SHIPYARD, LTD.

The "Canadian" Turbine Water Wheel



Manufactured by

Chas. Barber and Sons

Meaford, Ontario

Write for description, prices and references

Business Undertakings.

Barrie, Ont.

The Board of Light Commissioners are inaugurating an all day lighting service. A separate line for street lighting may be installed at a cost of about $2,000.

Chatham, Ont.

The city has finally accepted from the Colonial Engineering Co., of Montreal, the new gas producer engine for the city electric lighting plant, subject to the putting in of a new dynamo for the second-hand dynamo temporarily installed.

Hamilton, Ont.

The contract for new pumps and motors for the beach pumping house has been awarded to the Westinghouse Company of this city at $20,148. The General Electric Company tendered at $18,120 for pumps, motors and complete equipment, but it was decided to accept the local firm's tender because it included an additional starting motor. The tender of the John Montgomery Company, of Toronto, for a system to pump water to the Mountain top, for the use of the residents at the head of Wentworth street, was accepted. The price was $6,500. The tender covered compressor, motor, four tanks and two water elevators.

Kenora, Ont.

Aemilius Jarvis & Company have purchased $300,000 5½ per cent. town bonds, issued for the Hyrdo-Electric power plant.

Orillia, Ont.

The ratepayers have approved a by-law to raise $30,000 for the completion of the power plant.

Oshawa, Ont.

The corporation of Oshawa will make application at the next session of Parliament for power to construct and operate an electric light and power plant.

Orangeville, Ont.

The Dufferin Light and Power Company, Limited, have been incorporated with a capital of $200,000. The incorporators include; W. D. Wilson, W. P. McHenry and F. W. Scott, all of Toronto.

Ottawa, Ont.

Garrioch and Godard secured the contract of supplying the Civic Electric Commission with $2,000 worth of wire required for the civic plant.

Sorel, Que

The Sorel Light and Power Company, capatalized at $500,000, have obtained a charter. The incorporators include A. E. Pontbriand, L. T. Trempe, C. O. Paradis, and O. Paradis, all of Sorel, Que.

Toronto, Ont.

Mayor Oliver states that the first contract to be let by the city in connection with the distribution plant will be for the sub-stations and conduits. It is hoped to call for these this month.

Winnipeg, Man.

Samuel Hooper, Provincial Architect, has plans nearly ready for new telephone exchange building at Portage la Prairie.

Yellow Grass, Sask.

Richard A. Taunton, 512 McIntyre Block, Winnipeg, has formed a company called the "Yellow Grass Electric Lighting and Power Co." which will put up a plant at this town.

(See Page 35)

Paragraphs on Traction

It is reported that Canadian financiers are planning to subscribe sufficient funds to take the Chicago & Milwaukee Electric Road, headed by A. C. Frost, out of the hands of receivers.

The Montreal & Southern Counties Railway Company, which some time ago secured entrance to Montreal, has started construction on the Montreal section. John Quinlan & Company have secured the contract for the concrete work, and the United States Steel Company for the rails and other special work.

The Toronto Railway Company is investigating the merits of two fare boxes for use in pay-as-you-enter cars. One is the invention of William Cox, an employee of the company, and the other is that of Wm. Coleman, of Tottenham, Ont., and has been promoted in Buffalo and New York. Several officials of the company tried to beat both boxes without success, and there seems to be little choice between the two. The matter will be determined shortly.

It is not likely that the proposed improvements to the street railway system at Hamilton, Ont., will be gone on with this fall. The season is so far advanced that the company officials think it would be a mistake to start reconstruction work this year. They are, however, prepared to go ahead at once with the erection of car barns and shops providing the city will allow them to put down a single track on Wentworth street north and a double track on Sherman avenue from Main to Wlson streets.

The protective devices ordered by the Dominion Railway Board for the crossing of the Grand Trunk Railway and Toronto Railway Companies on Front street, Toronto, have been put into operaten after an inspection by officials of both companies. The system includes semaphores, gates and derails, and is considered the most complete in the city. Slowdown signals are placed on the street railway tracks 200 feet from the crossing, and all cars must come to a full stop 100 feet away from it. The gates are especially heavy and the western arm also protects Windsor street. The tower at the crossing has six levers, operating the semaphores, gates and derails on either side, and watchmen will be on duty day and night.

At a large public meeting held in Port Arthur recently, a resolution was signed by practically every one present, protesting against the proposed arrangement to hand over a portion of Port Arthur's street railway to Fort William, and calling upon the Ontario Railway and Municipal Board to wait until the legality of the agreement relating to the railway had been passed upon in the High Court of Justice. The claim is made that the proposed deal was arranged by aldermen of the two cities who met in Toronto, but were not authorized to make the arrangement, and that it was never ratified by the people of either city or by the Port Arthur Council.

The order of the Ontario Railway and Municipal Board, directed to Sheriff Thompson, to place the Port Arthur Street Railway in the hands of the joint board, composed of commissioners representing the cities of Port Arthur and Fort William, was carried out on November 19th.

Moira River Development Proposed

A deputation from Hastings County waited upon the Hon. Mr. Cochrane, Ontario Minister of Lands, Mines and Forests, recently and were promised consideration in regard to improving the Moira River's natural reservoirs in order to provide electrical power for Belleville, Tweed, Madoc and adjacent towns and mining districts to the north. The idea is to build dams at several lakes tributary to the river and thus prevent the water from all going down in the spring. The cost is estimated at about $35,000. The Hydro-Electric Power Commission engineers have already estimated that the river is capable of supplying an aggregate 24-hour horse-power of about 22,300. Like many other provincial rivers, however, its flow in summer is small, owing to the draining of swamps and other natural reservoirs. By concrete dams at the various lakes it is hoped to provide a consistent flow of water. The deputation was headed by Messrs. Henry Corby, ex-M.P.; J. W. Pearce, MP..P.; J. M. Johnston, M.P.P.; Amos Richardson, M.P.P., from the various ridings of Hastings, and Town Solicitor Mikel, of Belleville.

The 20th annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West 39th street, New York, December 1st to 4th. The president's address, to be delivered at the opening of the meeting, will be upon "The Conservation Idea as Applied to the American Society of Mechanical Engineers." A number of interesting addresses will be delivered, including papers upon aeronautics. Among the addresses will be one on Thursday, Dec. 3rd, by Norman Litchfield, upon the durability of gears in electric railway service. Prof. F. C. Agner will deliver an address on Thursday afternoon, Dec. 3rd, upon the "Possibilities of the Gasoline Turbine." On Friday, Dec. 4th, Prof. Richard G. Dukes will deliver an address showing tests on friction clutches for power transmission.

The New Orleans Telephone Company have made a demand on the Western Union & Postal Telegraph Companies for 15 per cent. of the tolls on messages delivered to city addresses by telephone. The telegraph companies maintained, however, that they are entitled to use their telephone instruments for any legitimate purpose, and refused to pay more for service than any other subscriber. It is stated that both the telegraph companies at Chattanooga, Tenn., ordered the telephone instruments taken out when a similar demand was made there

---

Victoria's Power Supply Outrun.

In a special report to the City Council of Victoria, B.C., City Electrician Hutchison states that he finds that the capacity of the present water source of power has been outrun by the growing demands of the city, and that it is imperative that steps should be taken to provide an ample supply. He finds, however, that the company had installed and are installing a sufficient auxiliary steam plant to produce ample power, added to that generated at Goldstream, to take care of present needs. In his report he says also that the B. C. Electric Company are taking means to prevent a recurrence of the recent difficulties from shortage of light and power.

Mayor Henderson, of Lethbridge, Alta., is advocating a street railway line for that city, and favors granting a franchise.

The Crocker Turbine

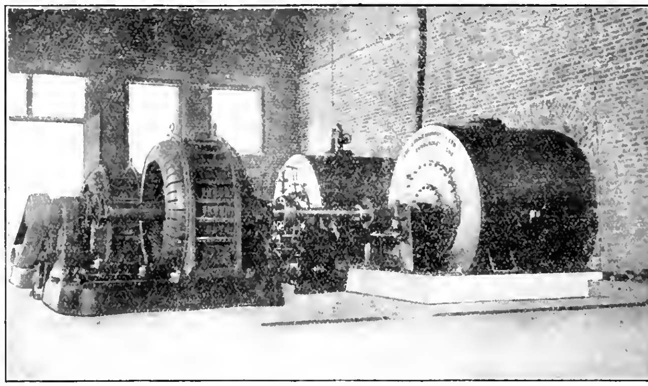
¶ Furnished in various styles of setting in all sizes and for heads up to 150 ft.

¶ Special settings designed to suit special locations when required.

¶ We give special attention to Hydro-electric installations for which the Crocker Turbine is perfectly adapted.

¶ If interested in hydraulic development we will be glad to submit plans and specifications.

¶ Specifications from consulting engineers are invited.



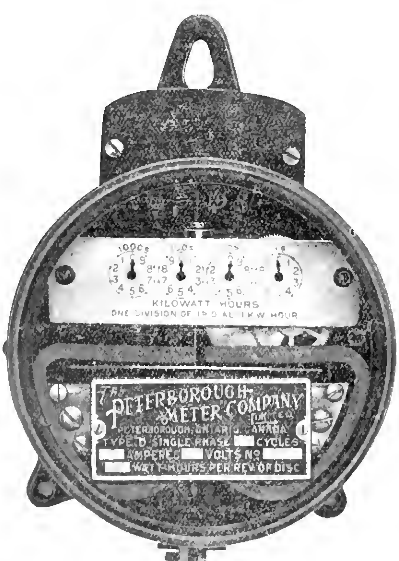
2 Pairs 21" Cylinder Gate Crocker Turbines direct connected to Electric Generators.

The Jenckes Machine Co., Limited

General Offices: Sherbrooke, Que.

Works, Sherbrooke, Que., St. Catharines, Ont.

Sales Offices: Sherbrooke, St. Catharines, Cobalt, Rossland, Vancouver.



Can Ship Immediately

Peterborough

Integrating Wattmeter

For Alternating Current

Dust, insect and moisture proof.

Is correct on all loads from two per cent. of its capacity to fifty per cent. overload.

Will run continuously and accurately on fifty per cent. overload.

Has no complicated parts, and the friction is reduced to a minimum.

Write for Prices and Bulletin "B"

Sole Selling Agent

John Forman

Electrical Supplies

248-250 Craig Street West, Montreal, Que.

Canadian Electrical News & Engineering Journal

PUBLISHED ON THE FIFTH OF EVERY MONTH BY
HUGH C. MACLEAN, LIMITED,
HUGH C. MacLEAN, Winnipeg, President.
THOS. S. YOUNG, Toronto, Business Manager.
JAMES FISHER, Toronto, Advertising Manager.

HEAD OFFICE - Confederation Life Building, TORONTO
Telephone Main 2362
F. W. SCHERBARTH, Representative.
MONTREAL - Telephone Main 2299. B34 Board of Trade
D. BURNSIDE, Representative
WINNIPEG - - - - Telephone 224. 404 Travellers Bldg
ROLAND F. HILL, J. R. HOOPER, Representatives.
VANCOUVER - Telephone 2248. Molsons Bank Chambers
GEO. A. GALL, Representative

SUBSCRITIONS.

The "Electrical News" will be mailed to subscribers in Canada, post free, for $1.00 per annum. The price of subscription should be remitted by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from United States and foreign countries embraced in the General Postal Union, $2.00 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of the paper.

EDITOR'S ANNOUNCEMENT.

Correspondence is invited upon all topics coming legitimately within the scope of this journal.

The "Canadian Electrical News" is the official paper of the Canadian Electrical Association.

Aluminum Lightning Arresters

The unit in the aluminum lightning arrester, of which we were speaking last month, consists of a pair of aluminum plates, known usually as a cell, this name coming in all probability from their resemblance to an ordinary battery, as they are set fairly closely to one another, viz., ¼-inch to ½-inch apart, with electrolyte in between. As opposed to a battery, though, the arrester has its plates placed one on top of the other, instead of side by side, in consequence of which they are made cup or cone shaped, in order to enable them to hold the electrolyte in between each pair. Besides this, such a shape makes the plate very much stiffer for a given thickness than if it were flat. Further, it lends itself very readily to supports, placed either in the centre or at the edges, the two main designs now on the market being built, one with a central rod, and the other with three or four, placed round the periphery. These, of course, must be of wood or some other insulating material, as otherwise they would simply form a shirt-circuit from cell to cell. The completed batterly of cells, after having the films formed on the plates as described in our last issue, is put into a tank, either porcelain or iron, an appropriate number of tanks being taken to make up a complete arrester, the exact equipment depending upon the type and voltage of the system The tanks, after the electrotype has been put in between the aluminum plates, are filled with oil, which serves the treble purpose of increasing the insulation, of preventing evaporation of the electrolyte, and of increasing the radiating surface of the cells, and thus decreasing their heating.

The normal working potential of this arrester is about 300 volts per cell, that is, one pair of plates is provided for every 300 volts, which would mean that on an ungrounded three-phase system of 23,000 volts some 70 odd cells would be needed between each leg and ground, and between legs, the well-known multiple connection being, of course, used for this arrester as well as for its predecessors. The break-down potential or the voltage at which free discharge takes place is some 40 per cent. greater than the normal working pressure, though, of course, both it and the normal point can be varied by using different electrolytes. The structure of the film, and with it the resistance of a cell, vary so much according to the potential applied to them that an arrester which at 300 volts per cell will pass but one ampere or less, will at a little over 400 volts allow a continuous discharge of something like 1,000 amperes. Obviously this, then, is a wonderful development of an electrical safety valve, and a device which undoubtedly makes a tremendous step in the art of lightning proprotection.

Contrary to the practice that is standard with the majority of other types of arresters, the aluminum form is not recommended for continuous connection to the line, at least in the higher voltage type. At the same time it is very necessary that it or any other arrester be ready for service at any instant, and so a horn air gap is inserted between it and the line, this device serving very well to prevent the constant leakage current which would flow if there were no gap, and at the same time being capable of such setting that it will break down with a very slight increase in the normal potential, and thus connect the arrester to the circuit as soon as it is really needed; that is, whenever any abnormal potential appears on the line. Another curious property of the aluminum arrester is that it must not be left continuously off the line, any more than it is desirable to leave it always in circuit, the reason being that the film tends to disintegrate unless current be passed through the arrester at intervals. Of course, if the films are gone the arrester becomes practically a dead short-circuit, as its resistance then disappears almost entirely, in view of which it becomes advisable to provide a charging mechanism. This is generally accomplished by arranging the horn gaps so that they can be swung closer together than their normal setting, when the potential immediately breaks across them, thus producing a small current flow, but still quite sufficient to keep the film fully formed. So far this charging,

though it is only a matter of a few seconds once a day, has to be attended to by the station attendants, in view of which the device is scarcely yet suitable for installation out on a line where there is no one to look after it. Further, the question of temperature has to be considered, as the characteristics of the cell change very materially if subjected to only ten to fifteen degrees of frost.

The various accessories that are desirable for the best operation of this very unique and valuable device, combined with the fact that it is entirely new, naturally make the cost materially higher than the forms which have heretofore been on the market. But when operating companies come to feel that the new design will really protect their lines, alternating or direct, high voltage as well as low, grounded or ungrounded, they will doubtless not hesitate for a second to make the investment required, for the real value of a perfect lightning arrester can scarcely be measured in dollars and cents.

Franchise Operating Companies and Their Customers

It is most unfortunate, but nevertheless true, that in a large percentage of our cities and towns the companies supplying public necessities, such as water, street railway facilities, electric light and power, etc., etc., are on anything but good terms with the citizens of their respective communities. This does not mean as at first sight would appear to be the case, that this state of affairs has been deliberately brought about by the companies concerned, because such organizations, or at least those of them who have competition, or those who, even without that stimulus, are alive enough to reach out after business, spend a lot of money through the various advertising channels in an effort to increase their output. Surely they would not do this if they really felt entirely independent of their customers the general public, and public opinion. Still the fact remains that a very great percentage of them entirely fail to recognize that they have, right at their doors and within their easy reach that biggest and finest and most valuable of all advertisements, namely, a satisfied clientele, if they would but do their part. Moreover, this most desirable state of affairs can be brought about at comparatively little cost, notwithstanding that some day it may prove to be the price of almost life itself, for without any doubt the general feeling in a community decides, much more frequently than it is generally given credit for, the success or failure of a move for municipal ownership. And municipal ownership is no joke, as those who own shares in companies operating within the pale of the Hydro-Electric Power Commission can just now testify.

It must be granted, of course, that an innate feeling of hostility to every public service corporation exists in practically all communities, ready, nay, more than that, anxious to become active if given but the slightest excuse, this feeling naturally being the cause of a great part of the many troubles that arise. But, properly speaking, this feeling should not be used as an excuse for the existence of disputes, as it so often is, but rather it should be a spur in the side of every manager, urging him on to see that as far as in him lies every legitimate cause for complaint, every possible source of irritation, is eliminated from his dealings with, and treatment of, the general public. We all know very well the thousand and one small points which go to make up what we call fair and proper treatment. We each watch them very closely as applied to ourselves, and are influenced thereby when placing our business, large or small, personal or otherwise, to a much greater extent than we perhaps realize. Why do so many of our public service companies neglect this elementary but highly important principle, which applies to bodies organized or unorganized just as well as to individuals, and thus make enemies of those who might otherwise be their very good friends. Pleasant relations between prospective buyer and seller go a long way towards consummating any proposed agreement, and are also of inestimable value during the life of a contract, smoothing over with great ease any differences which may arise and which may otherwise turn into serious disputes, very costly to both parties. And is not the operation of a public service company, on the one hand, and on the other the purchasing of its product, simply the carrying out of a contract, in view of all which it certainly behooves those operating public franchises to see that they are meeting their customers in a very broad and liberal spirit.

As an instance of an apparently small but a really most important point, quite capable of materially affecting the relations between the public and those serving them without competition, we would cite the handling of complaints. Do not make the fearful mistake of treating any complaint, even if you think it to be entirely unjustified, with anything but the greatest consideration. Investigate every complaint thoroughly, taking great pains to explain the company's position and side of the case until the objector cannot but grant that there are at least two sides to the question, and then, if you are in doubt, err on the easy side and make some slight concession. You will never have a better opportunity than this to throw a sprat and catch a herring. As opposed to this, the policy of treating complaints with indifference, of letting them be handled by any but the seniors on your staff, of allowing them to die a natural death from neglect, is sure to bring retribution sooner or later. We commend points such as this to the very earnest attention of all those connected with the operation of public franchises, as, while very small in themselves, they are fraught with the gravest danger if not most carefully watched.

The Nova Scotia Steel & Coal Company, Limited, are progressing rapidly with the development of their Wabana mine. They will install machinery shortly, and are figuring on an engine driven generator of about 500 K.W.

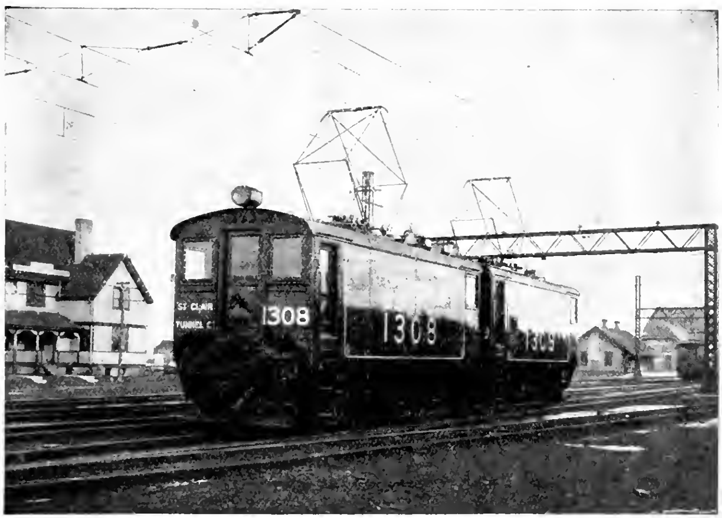
The Electrification of the Sarnia Tunnel

An Illustrated Technical Description of the Methods Used and Equipment Installed.

The disposal of the rainfall on the tunnel approaches required particular attention. The areas of the Port Huron and Sarnia approaches are approximately 11 and 13 acres respectively. Water precipitated on these areas during a rainfall is discharged into waste ditches on the bank above by means of pumps of large capacity.

The successful completion of the electrification of the St. Clair Tunnel was celebrated on Nov. 12th by the cities of Port Huron and Sarnia, in the presence of a number of officials of the Grand Trunk Railway and visitors from Canada and the United States. The actual completion of the work was accomplished in May last by the Westinghouse Electric & Manufacturing Company, but on account of the peculiar difficulties of the problem presented to the contractors, it was deemed advisable that working proof of the satisfactory solution of the difficulties should be afforded before the work was formally taken over by the railway company. This has been in progress for nearly six months and the company finally conceded that the Westinghouse Company had completed the work in a manner such as to meet all the demands of the situation. A special car on the Montreal train carried visitors from many intermediate points. At Sarnia the train was met by the mayors of the two cities and the party was taken to the American side, where they entrained upon specially decorated observation cars to make the trip of inspection of the tunnel. The trip under the river was made with every opportunity of observing the important changes which have been brought about by the adoption of the electrical system. The tube presented a bright and cleanly appearance and the purity of the air was particularly commented upon.

A complimentary luncheon was tendered to the visitors at the Hotel Vendome in the afternoon, at which over a hundred guests were present. A number of speeches were made and toasts proposed, among them being toasts to Engineer Joseph Hobson, Mr. Bion J. Arnold, consulting electrical engineer, the Westinghouse Company and its officials, the mayors of the two cities and the press. The toast to the Westinghouse Company and its officials was responded to by Mr. R. L. Wilson. In the evening a dinner was held at the Hotel Harrington, Port Huron, during the course of which the visitors frequently expressed their appreciation of the courtesy they had received and their admiration of the splendid manner in which the electrical system had been installed.



Locomotive in Sarnia Yards.

The following technical description of the work of electrifying the tunnel was prepared by Mr. F. A. Sager, assistant engineer, and Bion J. Arnold, consulting electrical engineer:

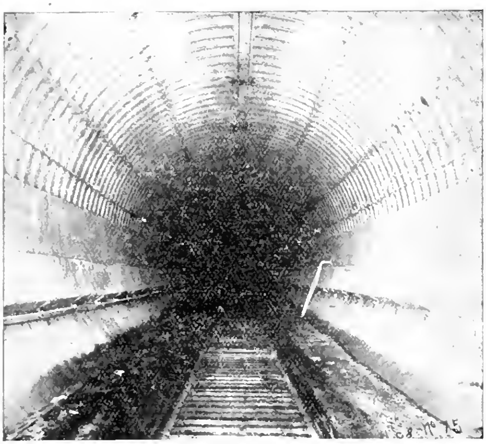
The Tunnel.

The tunnel, located under the St. Clair River, is the connecting link between the terminal of the Western Division at Port Huron, Michigan, and the terminal of the Eastern Division at Sarnia, Ontario. The length of the tunnel from portal to portal is 6,032 feet. The total distance between the American and the Canadian summits of the St. Clair tunnel is about $2\frac{1}{4}$ miles. The grade on the tunnel approaches and the inclined sections of the tunnel is 2 per cent., while the flat middle section of the tunnel, about 1,700 feet in length, has a grade of 0.1 per cent. downward toward the east, just enough to provide for the proper drainage of any seepage water. A single track extends through the tunnel, while a double track is laid in both the tunnel approaches

The tunnel shell consists of cast iron rings built up in sections, with an inside diameter of about 19 feet.

Retaining levees have been constructed to impound a large proportion of the water falling on the approaches. The pumps handle only the water falling on the central portion of the approach during the rainstorm. Later the impounded water is discharged into the pump sump by valves provided for the purpose.

Four steam locomotives of special design were in commission since the construction of the tunnel for handling the freight and passenger traffic. They were designed to provide the necessary high tractive effort required to operate the trains over the grades in the tunnel and on the approaches, and arranged to burn



Interior of Tunnel.

anthracite coal, in order to minimize the inconvenience due to excessive smoke in the tunnel. These locomotives have given good account of themselves, and have handled the traffic in a satisfactory way throughout their service. Their maximum tractive effort limited the weight of the trains handled to about 760 tons, and even with this load the speed up the 2 per cent. grade was often very slow. With the constantly increasing traffic, at times the capacity of the tunnel with its steam equipment was taxed in handling the tonnage, and it was thought desirable to make such changes as would increase its possible capacity for handling traffic, and at the same time do away with the presence of locomotive gases in the tunnel.

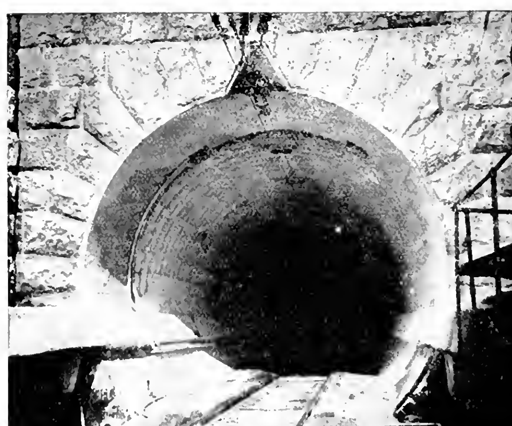
Proposed Systems for Increasing Capacity.

The advantage of the use of electric locomotives, on account of the freedom from smoke and the attendant discomfort, together with the possible greater economy in operation, led finally to the decision to provide an electrical equipment to handle the tunnel service, this equipment to provide for the operation of the trains through the tunnel by means of electric locomotives; the handling of the drainage and seepage water by means of electric pumps; the lighting of the passenger stations, the tunnel and the roundhouses by electricity, as well as furnishing a certain amount of power to the roundhouses; also, provision was made for a limited amount of outside lighting in the form of arc lamps. The different electrical systems available for such service were considered, and estimates as to relative cost and efficiency of the various systems were prepared and submitted to the Tunnel Company. These estimates covered the direct current system both with and without battery, as well as estimates on the alternating current systems. Complete specifications were prepared, covering both the direct and alternating current systems, and propositions on these received and considered. Decision was finally made in favor of alternating current, using a 3-phase system for the distribution of power required for pumping and for shop motors with single phase distribution for locomotives and lighting.

Service Conditions and Requirements.

The St. Clair Tunnel Company is operated as an independent division of the railroad, the trains being delivered by the Western Division in the yards at Port Huron, and taken by the tunnel locomotives through the tunnel, and delivered to the Eastern Division at the yards in Sarnia, the westbound trains being handled in the reverse order. The steam locomotives operating on the divisions adjacent to the tunnel are never operated through the tunnel.

In order to increase the capacity of the tunnel, it was desirable to provide for the maximum practicable tractive effort in the new locomotives. The capacity limit was determined by the maximum pull to which it was deemed wise to subject the drawbars on the mixed rolling stock that must be handled, without danger of breaking trains in two. For this reason the locomotives were specified of sufficient capacity to develop a drawbar pull of 50,000 pounds, when operating at a speed of ten miles per hour. It was estimated that such a locomotive would be able to make the complete trip through the tunnel from terminal to terminal with a 1,000-ton train in fifteen minutes, or four 1,000-ton



Trolley Supports at Tunnel Entrance.

trains per hour, which would provide a capacity for traffic about three times larger than the actual maximum demands up to the present time.

It was estimated that the pumping service, for which adequate provision must be made, would require the installation at the Sarnia portal of two pumps each of capacity of 5,500 gallons per minute, and at the Port Huron portal the installation of two pumps each with a capacity of 4,000 gallons per minute. To provide absolute continuity of service, duplicate pumping equipments were provided in each portal, as well as duplicate feeder lines leading from the power plant to the pump

houses. The pumps must always be in readiness for operation day and night throughout the entire year, which in case of electrical pumps simply necessitates the presence in the pump house of a pump operator and the continuous operation of the power plant.

The lighting service to be provided for is of minor importance in so far as the amount of power required at both Sarnia and Port Huron is concerned, this being somewhat less than 100 kw. The power requirement for motors in the roundhouses at Port Huron and Sarnia is about 100 kw. for both shops.

To furnish electrical energy for the service outlined above, provision must be made in the power plant for supplying single phase current for the electrical locomotives, 3-phase current for the pumping service, and 3-phase and single phase current both for the power and lighting service at various points throughout Port Huron and Sarnia, as well as for a small amount of arc lighting.

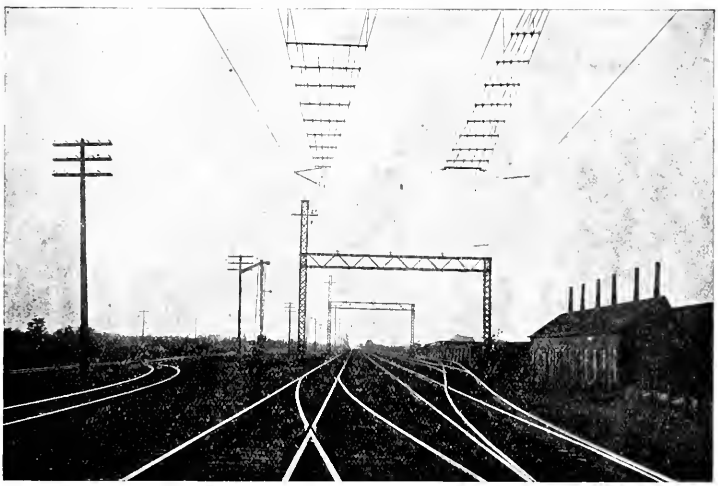
The Electrification Equipment.

Three locomotives have been provided for the service, each consisting of two half-units, each half- unit mounted on three pairs of axles driven through gears by single phase motors with a nominal rating of 250 h.p. each, the nominal horse power of the complete locomotive unit being 1,500. In so far as the electric motors have a very liberal overload rating, it is easily possible to develop 2,000 h.p., and on occasion in excess of this, in one locomotive. The half-units are duplicate in every respect, and as the multiple unit system of control is used, they can be operated when coupled together with the same facility that a single phase half-unit can be operated.

The locomotives are powerful enough to start a 1,000-ton train on a 2 per cent. grade in case this should be necessary. At a test made on a half-unit, using a dynometer car, it was found that a single half-unit developed 43,000 pounds drawbar pull before slipping the wheels. This was done on a comparatively dry rail, with a liberal use of sand. On this basis it would be possible to develop about 86,000 pounds drawbar pull with a complete locomotive. The maximum speed of the locomotives is 35 miles an hour. However, it is not the intention of the Tunnel Company to operate the locomotives at a speed in excess of 30 miles per hour. Speed indicators are provided, which indicate on a large dial located in the locomotive cab near the engine driver's seat the speed at which the locomotive is running, and at the same time record the speed throughout the length of the run. This assists the locomotive driver in keeping the speed of trains within prescribed limits at all times, and furnishes records of the exact speed of the trains throughout all trips, for the inspection of the superintendent of the tunnel.

The locomotive cab is rectangular in section, constructed of sheet metal supported by structural steel shapes. Inside of the cab are located practically all of the apparatus used in connection with the locomotive, with the exception of the motors and the brake rigging. Included in this apparatus is a single phase transformer used for reducing the voltage from 3,300 to a voltage suitable for application to the motor. The transformer, as well as the motors, are air-cooled, the supply of air being furnished by an electrically driven blower, also located in the locomotive cab. The blower is driven by a single phase motor, the current being supplied at 100 volts by a tap from the main transformer. With the moderate supply of cooling air furnished by the blower fan, both transformers and motors are able to operate at full capacity with comparatively little increase in temperature above that of the surrounding air. The air for the cooling is taken through a suitably designed shutter located in the side of the locomotive cab, and is distributed through sheet metal ducts installed under the cab floor to the three motors under the cab, and to the transformer. From the latter the air passes either through an opening in the floor of the cab into the open air, or, if desired, into the interior of the cab. In the latter case an appreciable amount of heat can be secured from the main transformer for utilization in heating the cab during cold weather.

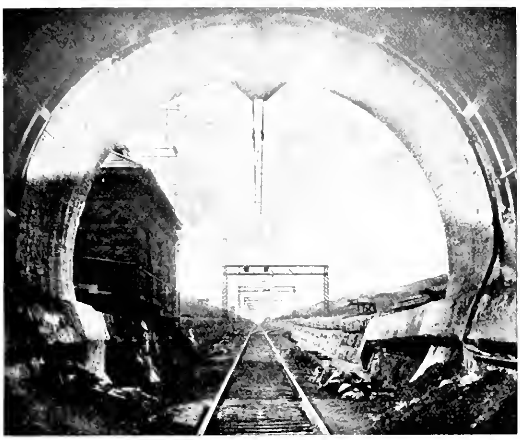
Motor driven air compressors are also located in the cab. The air brake equipment is of the standard type used for electric cars and locomotives, with the exception of the motors, which are single phase. They are operated by means of an electric controller, which serves to keep the normal air pressure at about 100 pounds. The



End of Electric Zone, Port Huron Yards.

compressed air is used for the purpose of operating both the automatic and straight air equipment on locomotive and train, and in addition for a variety of minor purposes in and about the locomotive. All of the contactor switches used in controlling the operation of the locomotives are air operated, the air valves being operated by direct current electrical control. This is also true of ringing the bell, blowing the whistle, raising and lowering the trolley, and the application of sand to the tracks.

Speed control of the locomotive is effected by varying the voltage at the terminals of the motors. This is obtained by making connection with various transformer taps by means of the air operated, electrically controlled contactor switches. Electric control of the contactors is effected through the master controller, which in the electric locomotive replaces the throttle valve in the steam locomotive. The current for the master controller is furnished by a small storage battery operating at about 20 volts, the battery in turn being charged by means of a small motor-generator set provided for the purpose. The electric controller has 21 points in all, 17 of which are running points. This provides for an increase in the speed of the locomotive from the lowest running speed to the maximum speed by very slight gradations, thus making it possible to maintain a practically constant drawbar pull, while the locomotive is accelerating the train. This is very desirable, in so far as the minimum variation in the drawbar pull while handling the train through the tunnel decreases the liability of breaking the train in two. Particular attention was given this phase of the train operation in designing the locomotive, and the result is a remarkable decrease in the number of breaks-in-two.



Port Huron Grade from Tunnel.

On the master controller is also located the reverse lever, which controls through the electrically operated solenoids the air operated contractors used in reversing the motor connections. Here also are located the push buttons, which serve to raise and lower the trolley, operate the front and rear sanders, reset the circuit breaker, and ring the bell. The ringing of the bell and the application of sand by means of the front and rear sanders are also controlled by foot pedals, thus making it possible for the operator to perform these functions while his two hands are employed in operating the master controller and the air. The balance of the equipment of each locomotive, consisting of the sand boxes, the seats for the drivers, ammeters, voltmeters, wattmeters, the banks of contactors, the preventive resistance coils, circuit breakers, auxiliary storage battery and motor generator set for charging it, are all installed in a compact manner inside of the cab, and are supported on structural steel work.

Each half-unit is arranged for operation in either direction; air valves, a master controller and ammeter being located at each end of the cab. By means of cable couplings, the control system of two or more half-units can be thrown in parallel, thus providing for the operation of any number of half-units from any master controller. In this way the two half-units are generally operated in the handling of freight trains through the tunnel. The passenger traffic can ordinarily be taken care of by a single half-unit.

The current is collected from the trolley wires suspended at a distance of 22 feet from the track by means of a sliding bow pantograph trolley. In so far as the trolley wire extends throughout the length of the tunnel, no additional provision has to be made for the collection of current while the locomotive is passing through the tunnel. Electric headlights are provided, as well as lights for the illumination of the interior of the cab and the dials of the indicating instruments. The heating of the cabs is provided for by means of standard electric heaters. Heat is also available for drying the sand stored in sand boxes. The general dimensions of the half-units are as follows:

Length over all	23 ft. 6 in.
Height from top of rail to top of roof......	13 ft.
Height from top of rail to top of pantograph bow when lowered	14 ft. 11 in.
Width of cab over all	9 ft. 8 in.
Total weight of locomotive half-unit, fully equipped	67½ tons.
(This weight is practically evenly divided over three drivers.)	
Weight of complete locomotive unit	135 tons.
Length of rigid wheel base	16 ft.
Diameter of driving wheels	62 in.
Normal speed of train, ascending 2 per cent. grade (miles per hour)	10
Normal speed on level tracks (miles per hour)	25 to 30

In service it has been found that the locomotives will very readily handle a 1,000-ton train at from 11 to 12, and possibly 13 to 14 miles per hour on a 2 per cent. grade, thus demonstrating their ability to more than fulfil the specified performance.

The Pumping Equipment.

The second service to be provided for electrically consists of the pumping necessary to free the tunnel approaches from water due to rain storms or melting snow, and the removal of a small amount of condensation and seepage water collecting in the tunnel. For this purpose pumping plants have been installed at both tunnel portals, that at the Port Huron entrance consisting of two centrifugal pumps, each capable of delivering 4,000 gallons per minute, driven by direct connected, 100 h.p., 3-phase, 25-cycle, 3,300-volt, induction motors, and that at the Sarnia entrance consisting of two 5,500-gallon pumps driven by two 200 h.p. motors of the same type. In addition a 150-gallon pump driven by small induction motor is located in each pump house, these pumps serving to take care of the small amount of water that is constantly finding its way into the drainage wells. The motors in the pump houses are controlled by

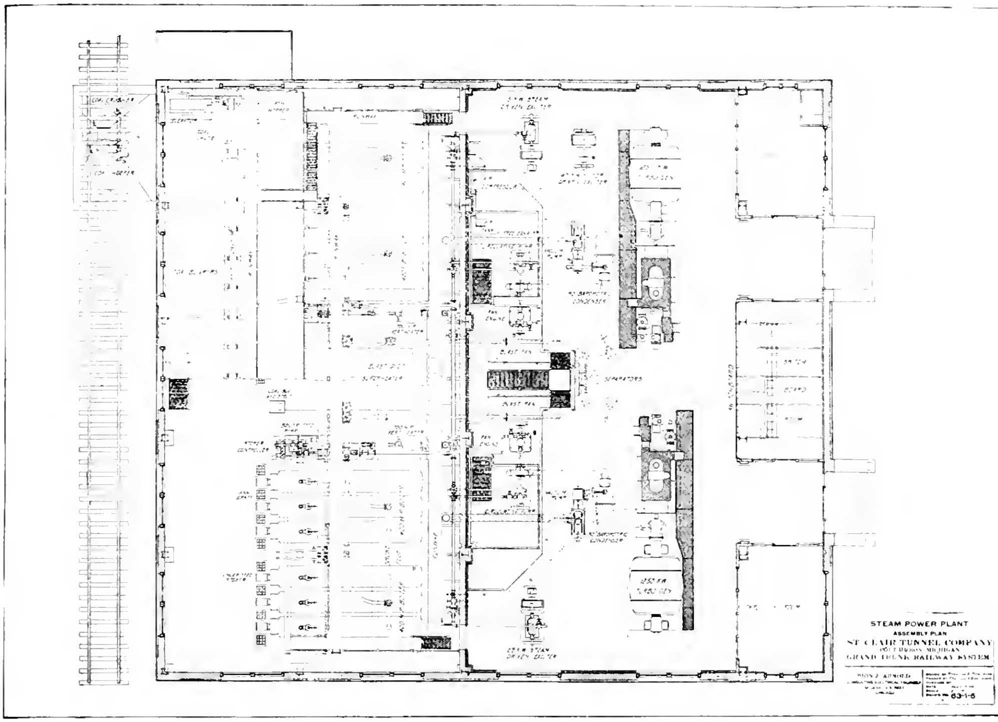
oil switches located on suitable panels. Provision is made on the panels for connecting the motor bus bars with either of two feeds leading from the power plant.

The centrifugal pumps used in this service can be primed by means of the water stored in the large discharge pipes. Valves controlling the flow of the water are all located so as to be conveniently accessible for the pump house operator. The equipment has been found to operate in an entirely satisfactory manner, and provides for the handling of water with a minimum amount of attendance and expense.

Two 150-gallon, motor-operated, centrifugal pumps are located at the foot of the Sarnia grade, and serve to remove from the tunnel the condensation and seepage water, delivering it to the well at the Sarnia portal. The seepage pumps are similar to the small pumps installed at the portal pump houses, with the exception of motors, which for this service are entirely enclosed, suitable for continuous operation in the tunnel, where they are liable to be subjected to more moisture than are the motors located in the pump houses.

Lighting and Power.

Incandescent lamps in the roundhouses, the passenger stations, the Young Men's Christian Association buildings in both Port Huron and Sarnia, installed previous to the electrification of the tunnel, are now being furnished with current from the electric power plant by means of step-down transformers, reducing the voltage from 3,300 to 110 volts. Motors operating at 3,300 volts have been installed in the roundhouses at Sarnia and Port Huron, the current supply being taken from the power plant. In all, 480 lights have been installed throughout the tunnel on either side at a height of ten feet above the rail. The tunnel lamps are operated four in series from the 440-volt secondaries of the lighting transformers installed in the tunnel. Similar transformers furnish the current supply for the tunnel drainage pump motors. In addition about 30 arc lights have been installed in the yards at either terminal. These arcs are used for general illumination around passenger stations, roundhouses, and coal chutes. The current for the arc lights is furnished at the power plant by means of a mercury arc rectifier. The total amount of lighting is somewhat under 100 kw., which, together with the motor requirements of 100 kw., makes a total slightly over 200 kw. for small power and lighting outside of the plant.

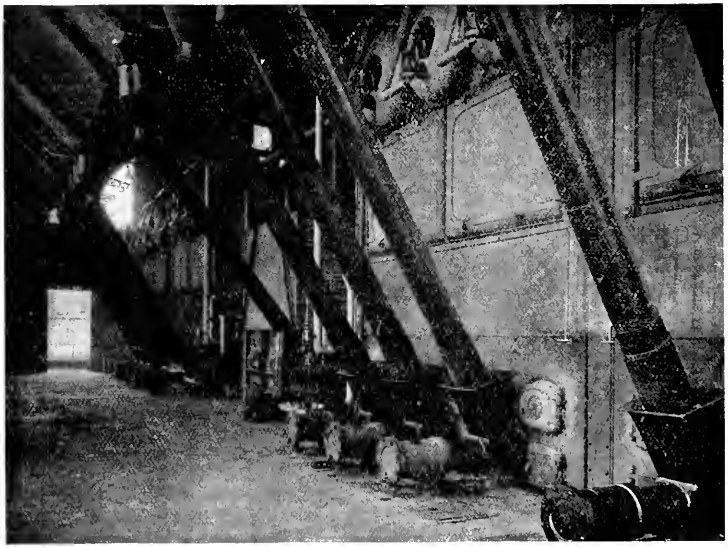


Plan of Power House.

Electrical Distribution System.

For distribution of the single phase current to the locomotive, substantial steel towers have been erected throughout the tunnel yards. The steel work used for supporting the working conductor consists of strong lattice columns supporting bridges of trussed construction. The average spacing of the overhead bridges is 250 feet. They are designed to extend over all tracks that are to be electrified, and in case of those located at passenger stations extend, in addition, over the platforms, thus in no way interfering with the access of passengers to and from the trains. This necessitates a length of about 141 feet, in ease of some of the bridges located on the Port Huron side, in which case the bridge spans seven electrified tracks, in addition to the station platform.

Single catenary construction is used throughout, a messenger cable of 5/8-inch extra heavy galvanized steel being suspended on the insulators located on the overhead bridges immediately over the centre lines of the track to be equipped. The working conductor is attached to the messenger cable by means of fittings of varying lengths so arranged as to support it at a uniform height of 22 feet above the top of the rail. Number 4/0 hard-drawn grooved copper is used throughout the yards, and at all places, excepting on the tunnel approaches and throughout the tunnel, on which sections two 300,000 c.m. conductors have been installed. The messenger cables forming the catenary construction terminate at the tunnel portals, where they are securely anchored to eye bolts imbedded in the heavy masonry portal. At this point the messenger wires supporting the working conductor throughout the tunnel are anchored to special brackets located on the tunnel face. The working conductors in the tunnel are continuous with those on the tunnel approaches.



Boiler Room in Power House.

The method of supporting the trolley inside of the tunnel shell was conditioned by the requirement that complete overhead equipment should not encroach on the tunnel opening more than 9 inches. This has been accomplished by bolting to the tunnel shell special iron brackets, each of which supports two spool-shaped insulators. These insulators in turn support steel messenger cables, which are drawn taut throughout the length of the tunnel, and attached at the tunnel portal to special brackets. Special clamps are attached to these messenger cables at points between the insulator supports, and these in turn serve to support the two trolley wires. The insulating supports are attached to the tunnel shell at intervals of 12 feet, as also are the clamps connecting the messenger cable with the trolley. This method provides an attachment at once sufficiently rigid to maintain the proper clearance between the trolley and the tunnel shell, and at the same time sufficiently flexible to provide for the proper operation of the trolley bow on the overhead conductor. Section switches have been provided where necessary to permit of disconnecting the working conductor over any switch track from the main line extending throughout the tunnel.

The columns at one end of the transmission bridges have been lengthened for the purpose of supporting the transmission wires which supply current for the power and lighting service at the roundhouses and stations, as well as for the arc light circuits. Overhead lines terminate in the pump house, at either tunnel portal, where they are connected with the underground feeder system at the panel boards.

All feeder lines connecting the various parts of the equipment to be supplied from the power plant are carried in the tunnel conduits. For this purpose four conduit lines have been laid on either side of the tunnel throughout its length. Connection has been made with these conduit lines at a point about 1,700 feet from the Port Huron portal, with a vertical shaft extending from the top of the tunnel to the surface of the ground, terminating at a point about 75 feet from the power plant. The overhead feeders, terminating as above noted in the portal pump houses, are continued as underground feeders down through the tunnel and up the shaft, finally terminating in the switchboard at the power plant. For the pumping service, two independent feeders are laid from each portal pump house, one being installed on either side of the tunnel and both terminating at the power plant switchboard. The heavy feeders for supplying the locomotive current to the trolley extend from the tunnel through the vertical shaft to the power house. This arrangement provides for all feeders leaving the power plant underground. The cables are paper insulated, lead encased and are installed in tile ducts.

The Power Plant.

The building:—The power plant is located on the Port Huron bank of the St. Clair River, about 100 feet distant from the centre line of the tunnel. Sufficient space is afforded between the building and the river front for side-track, a spur of the Grand Trunk Rail-

way, which is used for bringing in coal and various supplies needed for the operation of the power plant, as well as the removal of ashes. The proximity of the river makes it possible for coal to be received and handled by boat in case this should be found desirable. The power plant building covers a ground area approximately 100 feet square. The building is divided longitudinally by a fire wall separating the boiler from the turbine rooms. In the front elevation ,the height of the brick work above the water table is about 36 feet, the water table being about 2½ feet above the grade on the front side of the building. As the building is located on the side of a hill flanking the river, the ground line falls away rapidly alongside of the building until the grade line of the dock is reached, which is maintained for all entrances at the rear, this being 24 feet below the street level. The foundation up to the water table is constructed of mass concrete; the building superstructure is of steel and massive paving brick of dark brown color.

The foundation footings for the buildings were carried down at all points into the clay, which is found underlying the surface soil. They were designed for bearing pressure of two tons per square foot. All of the column footings supporting the coal bunkers, as well as the footing underneath the stack, receive additional support in the way of piling, the location on the river bank making it advisable to take this additional precaution.

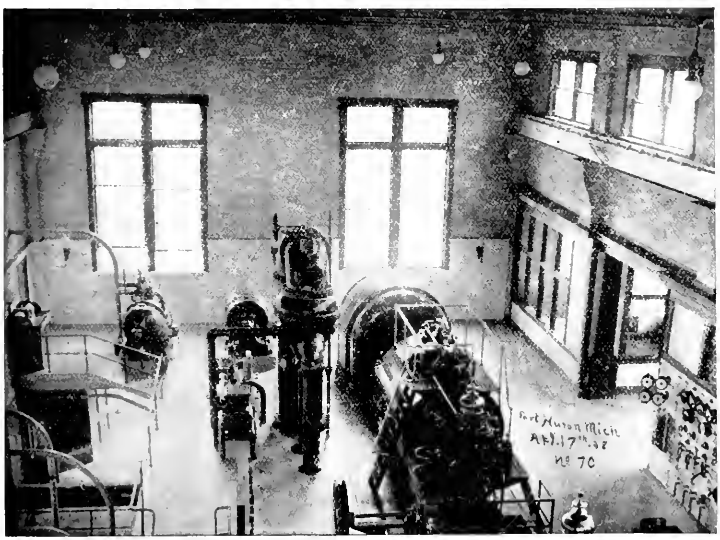
The self-supporting steel structure is carried on concrete foundation walls and footings. The steel work carries not only the reinforced cinder concrete roof, but in the turbine room the runway for the travelling crane, and in the boiler room the reinforced concrete coal bunkers. The brick building walls are also carried on the concrete foundations, and are built about the steel columns. The walls are finished at the top with a parapet capped with concrete coping.

The general artificial illumination in the building is taken care of by means of Nernst lamps, eight of which are provided for the illumination of the turbine room, these being suspended from the lower chords of the roof trusses, and two for the boiler room. In addition, nearly 200 incandescent lamps are used for illumination in various parts of the plant. Four incandescent lamp clusters are mounted on cast iron pedestals on either side of the two front entrances of the building. Hooded lamps are installed over all side entrances, as well as over the coal-receiving hopper at the rear of the building. All passage-ways behind and above the boilers, along the pipe lines, as well as those leading to and over the coal bunkers are well lighted, the lights being controlled by switches located at convenient points.

The water supply for house use in the power plant is furnished by a service pump and drawn either from the city water mains or from the St. Clair River, as desired. The necessary heating in the offices has been taken care of by radiators receiving their steam supply from auxiliary header of the power plant.

The coal and ash handling.—Coal is delivered to the plant in hopper cars, which are run over a wooden trestle leading above the receiving hopper, into which it is dumped by gravity. The coal-receiving hopper feeds directly into the crusher, which has a capacity of about 30 tons per hour, and which acts at the same time as a feeder, delivering the coal at a uniform rate to the vertical bucket elevator extending to the top of the building. From the vertical elevator the coal is fed by chutes into a conveyor belt, from which it is discharged by an automatic tripper arranged to deliver the coal at any point above the bunkers. Slow speed induction motors of the squirrel cage type drive the coal handling apparatus, a 20 h.p. motor being used in the crusher and a 10 h.p. motor installed in the pent house at the top of the building for the operation of the elevator and conveyor.

The coal bunkers are constructed of reinforced concrete resting on the steel building columns. The space occupied by them, located in front of and above the boilers, is separated entirely from the boiler room by metal lath partition, thus practically insuring the exclusion of coal dust from the boiler room. In a similar way the coal crusher pit and the coal elevating mechanism



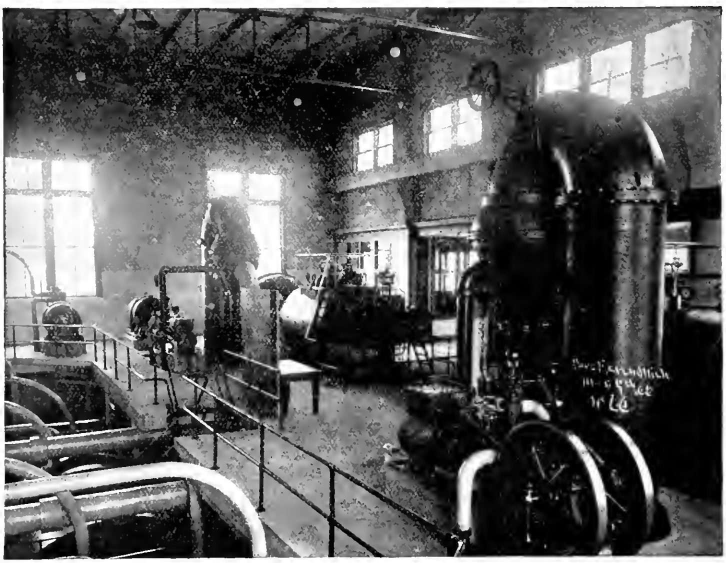
Turbine Room (from Crane).

are enclosed as completely as possible. Coal for firing purposes is drawn directly from the bunkers, through sheet metal chutes, into the stoker hoppers, which are located in front of the boilers.

The ashes are drawn from the grates of the boiler furnaces onto the boiler room floor, where clingers are broken and delivered through a coarse grating into the ash hoppers which are suspended underneath the floor. From the hoppers they fall by gravity through ash grates into the push cars, and are dumped into an ash chute connecting with the coal elevator. The elevator, when handling ashes, discharges into a spout leading to a small ash bunker at the end of the building. From this bunker they can be delivered by gravity into cars alongside the power plant.

Stokers.—Jones under feed stokers are installed in the plant, six being used for each battery of two boilers, making a total equipment of twelve stokers. Forced draft is supplied for each battery by an American Blower Company steel plate fan 11 feet in diameter and 3 feet 5 inches wide, driven by 10x10x10 type B enclosed vertical engine directly connected to the fan shaft. These fans are located in the pit of the turbine room. By means of a special blast gate in the galvanized iron duct leading from the fans to the boilers, either battery of stokers may be supplied from either of the fans. Each battery of stokers is controlled by a Cole Automatic Regulator, which is driven from the shaft belted to the fan engines. Friction clutches on this shaft supply cross connection for driving either of the Cole Regulators from either engine. This driving mechanism, together with the galvanized iron ducts and gates, is suspended from the ceiling of the boiler room basement.

On account of the very great variation in the load on the power plant, special precautions were necessary for the control of the fires under the boilers, in order to keep the steam pressure fairly constant. This is accomplished by means of the Jones stoker equipment, which controls the fire automatically, both by regulating the air forced through the stokers and the rate of feeding of coal into the boiler furnaces. This regulation is accomplished by means of a Kitts regulating valve, which acts as a throttling valve on the fan engines. This potential piping leading from the regulator is connected to the main steam header between the superheater and the turbine. In case the pressure in the steam lines tends to drop, the Kitts regulating valve increases the supply of steam to the fan engine, thus at the same time increasing the amount of air supplied to the boilers, and the frequency of operation of the stokers. In case the boiler pressure tends to rise, the Kitts valve decreases the supply of steam to the fan engine, thus decreasing the amount of air and coal supplied to the furnaces. This apparatus is entirely automatic, and has been found to control the steam pressure very closely.



Turbine Room.

Boilers.—The boiler equipment consists of four 400 h.p. Babcock & Wilcox sectional water tube boilers arranged in two bateries of two each, each boiler having three drums 42 inches in diameter and 23 feet 4 inches in length. This results in an unusually wide boiler, the tubes being arranged nine high and twenty-one wide, in order to secure quick steaming. This requirement is a necessary complement to the automatic stoker control referred to above. In addition the three drums provide storage for a large quantity of heated water available for quick steaming on any decrease in pressure. The boilers are designed to carry 200 pounds steam pressure, each unit being equipped with two tandem connected $2\frac{1}{2}$-inch Morris blow-off valves, the necessary pressure gauges, water columns, check valves, high and low water lines and other fittings.

Smoke Flue and Stack.—The smoke flue, located in the boiler room basement floor, is built of reinforced concrete. The boiler flues open directly down into the smoke flue, which in turn leads in a straight line through the south building wall to the reinforced concrete stack. The height of stack from the top of the smoke flue is

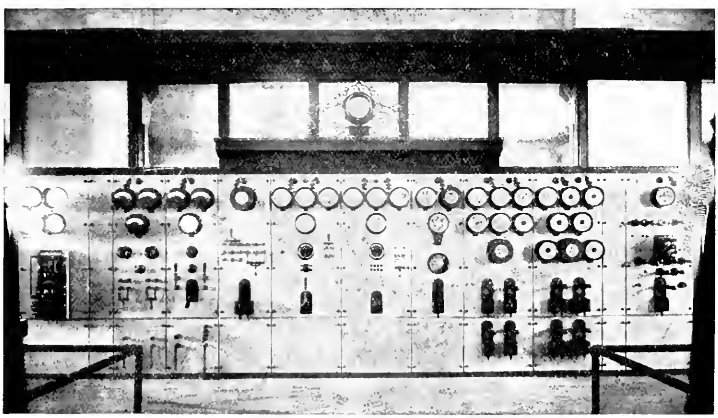
150 feet, or 162 feet above the basement floor. It was built by the Weber Steel-Concrete Company. Lightning protection has been applied to the stack in the form of standard equipment furnished by the Ajax Conductor & Manufacturing Company.

Superheater.—The separately fired Foster superheater is located between two batteries of boilers, and was furnished by the Power Specialty Company. The superheater has a capacity to add 200 degrees of superheat to 36,000 pounds of steam per hour. The superheater is hand-fired, but requires very little additional attention, as it is provided with automatic temperature regulator, which, by admitting air either above or below the fires, serves to control the superheat within narrow limits, approximately 30 degrees. The regulator consists of a thermal coupling installed in the superheater steam outlet, which in turn operates through a relay and solenoid on the by-pass valve of the hydraulic cylinder, the piston of which directly controls the dampers in the air ducts. The regulating device is so adjusted as to provide a superheat of about 100 degrees under actual working conditions, and has been found in operation to very closely control the temperature of the steam, notwithstanding the great variation of load to which the power plant is subjected.

Piping.—The steam is supplied by the boilers at 200 pounds pressure, and is delivered through the system of high pressure piping either to the superheaters and thence to the turbines, or through by-pass connections directly to the turbines, steam separators being installed in the piping system adjacent to the latter. The long sweep bends connecting the boiler nozzles with the main header are of 6-inch extra heavy pipe. The short header connecting the two batteries of boilers, in which are located the valves leading to the superheater and turbines, is 8 inches in diameter, while the lines from the header to the turbines are 7 inches. The fittings throughout are of mild steel, and designed for heavy pressure with superheated steam. All high pressure piping is provided with welded flanges. The necessary drips have been supplied for the proper draining of the high pressure system. An auxiliary header 6 inches in diameter, operated at 125 pounds, is installed along the boiler room wall at the rear of the boilers. From this header the steam supply is taken to all of the steam auxiliaries in the plant.

The free exhaust piping from the back pressure relief valve is of 14-inch spiral riveted steel pipe, extending through the boiler room basement and thence up through the roof. The auxiliary exhaust is made of 8-inch pipe, supported in the boiler room along the fire wall, and receives the exhaust steam from the various auxiliaries in the plant. Steam is delivered by the header to either of the enclosed heaters installed in the boiler room just back of the superheater. A 12-inch Cochrane oil separator is installed in the exhaust steam line just before it enters the feed water heater. Goubert type B vertical water tube heaters, each of 700 h.p. capacity, are used. A 4-inch spiral riveted pipe for free exhaust leads from each heater up through the roof.

Condenser and Boiler Feed Water Supply.—The condensing water is obtained from the St. Clair River, a concrete intake provided with structural steel grid and woven wire screen being installed along the dock line. From the intake the water flows through an 18-inch tile to the cold wells located below the centrifugal circulating pumps in the pit of the turbine room basement. Water is delivered from each of these by the circulating pump through the condenser, and is discharged into the hot well below the condensers. From the hot wells the water flows through an 18-inch pipe into a sump under the boiler feed pumps. These pumps deliver the water through the feed water heater to the boilers. Excess water in the pumps is discharged through an 18-inch tile pipe emptying into the river. A 3-inch Worthington water meter is connected between each of the feed pumps and the heater. The city water supply is connected to each feed pump by a 3-inch tap. In addition, the suction of the feed pumps may be connected to the cold water intake, thus making three sources of supply for the boiler feed water.



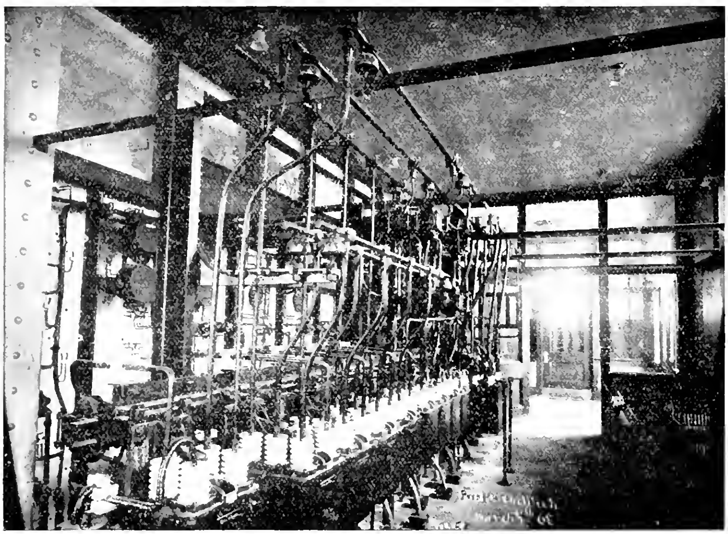
Switchboard in Power House.

Pumps.—Each battery of boilers is fed by a 12x6x10 duplex- outside, end-packed Worthington boiler feed pump. In addition water is provided for various other purposes, such as cooling the lubricating oils in the turbines, supplying the glands of the turbines, for hose connections in and about the power plant, all of this being supplied by a small Burnham service pump, drawing supply from one of the cold wells. The discharge pressure on the water system supplied by this pump is maintained by a pressure-regulating valve at about 75 pounds. A connection containing a check valve is made from the city mains to this piping. In so far as the city pressure is carried at about 45 pounds, the entire water

supply will be furnished normally by the service pump. In case, however, the service pump should fail to operate, the necessary water supply will be forced in from the city mains through the check valve.

Turbo-generators.—Two Westinghouse Parsons turbo-generators have been installed in the plant. The machines are designed to operate at a normal voltage of 3,300 volts, with a frequency of 25 cycles per second. They are 3-phase machines, but are further required by the specifications to furnish their full rated load of 1,250 k.w single phase current. The turbines are approximately 37 feet over all, 6 feet in width, and 8 feet high, and designed to operate at 1,500 r.p.m. The generators are cooled by means of air drawn through the coils by vanes installed on the rotor. A speed limit device is arranged to cut off the supply of steam in case the speed of the turbine exceeds a predetermnied value.

Condensing equipment.—Barometric jet condensers with 30-inch inlet, manufactured by the H. L. Worthington Company, have been installed in connection with



Back of Switchboard.

each of the steam turbines. A 36-inch exhaust pipe connects the exhaust outlet of the turbine with reducing fitting attached to the condenser head. A 14-inch automatic relief valve is installed in connection with the exhaust fitting, and connected to the free exhaust piping The cooling water for each condenser is furnished by a 10-inch volute pump driven by 7x9 vertical engine. The rotative straight line vacuum pumps, 8x6x12 in dimension, are supplied in connection with each condensing equipment. The dry vacuum pumps are located on the turbine room floor alongside the condensers, while the circulating pumps are located in the open put in the turbine room basement, where they are in plain view from the turbine room floor.

Exciters.—Two steam-driven exciters have been installed in the plant, each of 25 kw. capacity, this being sufficient to provide excitation for a single turbine. In addition a motor-driven exciter of 40 kw. capacity is installed, and is ordinarily used in the operation of the plant, the two steam-driven exciters being for additional security so far as continuity of service is concerned. The generators of the steam-driven exciters are of the Westinghouse Electric & Manufacturing Company make, and are driven by Westinghouse Machine Company vertical type engines. Both generator and motor of the motor-driven exciter are of Westinghouse manufacture, the motor being 3-phase, 3,300-volt, of the squirrel cage induction type.

Switchboard.—The switchboard, also of Westinghouse make, contains ten panels, and is made up as follows: One panel on which is mounted the Tirrill regulator, the voltmeters, frequency meter, and synchroscope; two panels, one of which controls the two steam-driven exciters, the second of which controls the motor-driven exciter; one panel for the control of the current supply for power and light in the plant; two panels for the control of the two turbo-generators; one panel for the locomotive feeder; one for the pumping feeders; one for the power and light feeds; and one for the control of the arc light circuits.

All of the high-voltage oil switches are located on structural steel frame work in the switch room directly behind the switchboard, no high-tension current being brought to the switchboard itself. Direct current at 125 volts is supplied for excitation, this being controlled from the main switchboard. The power plant lighting current is supplied as alternating current, through step-down transformers installed in a high-tension compartment underneath the switchboard room, by means of which the 3,300-volt current is transformed to 110-volt for lighting distribution in the plant. By means of a special switch the lighting system can be transferred from the secondary of the transformer to the exciter bus bars.

The switchboard panels are provided with standard apparatus, such as ammeters, voltmeters, and indicating wattmeters. Recording wattmeters have been installed as well, and so located as to measure the output of the plant required for the various kinds of service, namely, the locomotive service, pumping service, and lighting service. The voltage control of the generators is provided for by the installation of a Tirrill regulator, which controls the voltage of the locomotive phase. The light-

ing load is carried on this phase as well, and is thus free from the large voltage variations that are liable to occur on the other phases.

The station for the operating engineer is directly in front of the switchboard, from which point all the electrical indicating instruments, as well as the switches used in the operation of the plant are accessible. On the opposite side of the turbine room, facing the switchboard, is a gauge board, on which are installed the various gauges, both indicating and recording, giving full information with regard to the operation of the boiler plant. Ths arrangement brings to the immediate view of the operating engineer all information necessary in actual running of the plant.

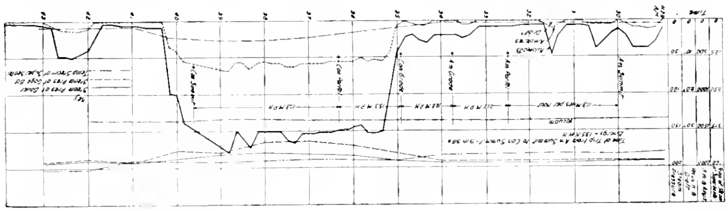
Travelling crane.—A hand-power travelling crane of 15 tons capacity, manufactured by the Northern Engineering Works, is installed on runways in the turbine room, by means of which all parts of the equipment in the room can be conveniently handled.

Construction and Operation of the Electrified System.

The entire electrical equipment has been in preliminary operation during the larger part of the year 1908. The work of construction was done without any material interference with the traffic through the tunnel. The greatest difficulty was experienced in carrying out that part of the installation located in the tunnel proper. For this purpose the tunnel was given over to the contractor for construction purposes for two 2-hour periods each day during the time that actual construction was in progress in the tunnel. The construction of the overhead work in the yards was carried out without any serious interference with the ordinary traffic of the road, and the power plant construction, being entirely removed from any of the properties operated by the St. Clair Tunnel Company, was not subject to any interference on account of railroad operation.

The problem of transferring the operation of the St. Clair Tunnel Division of the Grand Trunk Railway System from steam to electricity gave rise to another problem which was successfully solved by the mutual co-operation of the representatives of the Tunnel Company and the contractor. No attempt was made to make a sudden transfer, but every precaution was taken, not only to thoroughly test out all electrical equipment before attempting to use it in regular service, but also to allow ample time in which to familiarize thoroughly all those connected with the operation of the equipment with their work. Steam locomotive engineers were trained in the use of the electric locomotives. The force required for maintenance of the locomotives and for maintenance and operation of the power plant were secured and assigned their duties during the time that the first experimental and test runs were made with the equipment. When everything was in readiness, test runs were made with light locomotives through the tunnel, and later, moderate-size trains were taken through the tunnel as test loads, and finally a limited number of regular trains were handled by the electric locomotives. In this way, by gradually increasing the amount of work done by the electrical equipment, the entire operation was transferred from steam to electricity. The fact that no delays worthy of notice have occurred, either during the time of partial operation, or later, during the time of preliminary electric operation, is worthy of speceal note, indicating as it does not only the high character of the system so far as design and construction is concerned, but as well the conformity to the operating conditions that must necessarily be made in changing the operation of a division of a railway system from steam to electricity.

Some of the salient features in the operation of the plant may be seen by reference to a typical load curve. This curve is a graphical log of the operation of the plant during the time required for the passage of trains from one terminal to the other. It shows at a glance the power required by the locomotive, and the variation of boiler pressure, forced draft pressure, superheat, etc., during the cycle represented by train movements in the tunnel. The efficiency of all parts of the equipment is fully up to the contract requirements, and in fact in many cases the performance is found to exceed that guaranteed. From the results of preliminary operation it appears that the economies which will be effected by the electrification will be slightly in excess of the attainment estimated at the time the preliminary report on the proposition was submitted. This satisfactory showing, together with the entire elimination of obnoxious gases from the tunnel, is a source of congratulation to the railway company, together with those connected with the enterprise in an engineering or contracting capacity.



Graphical Log of Power Plant Operation; Condensing. Run No. 3—May 28, 1908.
(Weight of Train with Locomotive, 1,020.5 Tons.)

The first meeting of the Electric Club of McGill University was held in the Macdonald Engineering Building, on November 3rd. The meeting was largely attended, over 60 undergraduates of the faculty of applied science being present. Mr. Soper, Science '09, was the speaker of the evening, his subject being "The Electric Development Company of Ontario." The lecture proved to be a very interesting one, Mr. Soper having been connected with the construction of this huge undertaking at Niagara Falls. The lecture was illustrated by lantern slides. Mr. R. Mulock, president of the club, was in the chair. Prof. Herdt, honorary vice-president of the club, congratulated the members present on the good start that was being made. A spirited discussion took place on the paper, in which a large number of the members present took part.

The Engineering Society of Queen's University, Kingston, Ont., will hold its annual dinner in Grant Hall on Dec. 9th.

New Equipment for Kingston Locomotive Works

Description of Modern Plant Installed for Electrical Generation and Transmission of Power.

In a paper recently read before the mecahnical section of the Canadian Society of Civil Engineers, Mr. Henry Goldmark, M.Can.Soc.C.E., described the improvements which have been made at the works of the Kingston Locomotive Company, Kingston, Ont. Referring to the power plant, he said:

The power, previous to the improvements, was supplied by three separate steam engines, and distributed to the tools by shafting and belting. The lighting system, mainly of incandescent lamps, was incomplete. The shops were heated in part by exhaust steam, but live steam was also used to a considerable extent, especially in very cold weather. It was decided to subsubstitute a central power station large enough to supply the power, light and heat now required, and arranged so as to permit of ready enlargement in the future.

The desirabilty of installing gas engines operated by producer gas was made the subject of some little study. Where the question of heating need not be considered it is believed that a plant of this kind will produce power more cheaply than steam engines and boilers. This will be the case even with much higher coal consumption than that claimed by interested parties, and taking into account also increased fixed charges on first cost of plant. In case, however, the exhaust steam can be utilized for heating purposes, a steam plant will not only be simpler but generally more economical in operation as well as first cost. In a climate like Canada, with long and severe winters, this will be the case except in rare instances. A steam plant with electrical generation and transmission of power was therefore adopted.

In view of the compactness of the plant and the nature of the work to be done, it was decided to use a continuous current throughout, generating it at 250 volts, and using this voltage in all motors with a two-wire distribution. All lamps are for 125 volts, with a three-wire distribution, a 10-kilowatt balancer set being used. An analysis of the probable requirements was made on the basis of the actual indicated horse power of the engines in use, with proper allowance for the existing shortage of power which had not permitted all tools to run at their full capacity. The figures so obtained were checked by comparison with the requirements and load factors for similar machine shops elsewhere, especially at the Angus shops of the Canadian Pacific at Montreal, the figures for which were kindly placed at the writer's disposal.

Apart from the crane lods, which are intermittent, the present requirements for power and lighting were computed at 240 kilowatts at the switchboard. This estimate has been confirmed by the actual average 10-hour load for December last, which was 228 kilowatts, as taken from the switchboard readings. The size of the power plant, and the several parts of its equipment, were based on the above power requirements, as well as on the steam required for operating the necessary air compressors and for heating. A reasonable provision for spares was made, and the building is of ample size to allow for future increase in equipment. The building and equipment are briefly described in the following sections of this paper.

The Power House

The base of the entire power house consists of a concrete slab about three feet thick, which rests on piles spaced three to four feet apart and driven to bed rock. The slab supports the walls, floors and boiler and engine foundations. The space between the top of the slab and the finished floor level, where not occupied by foundations, is utilized for pipe trenches, all remaining voids being filled in with earth. The building has a steel frame, of columns and roof beams, 20-inch concrete walls, and a hollow tile and reinforced concrete roof on the Kahn system. Practically all the steel work is protected by concrete. The engine room has a tiled floor, an enameled tiled dado, and painted concrete walls. The entire building is fireproof except as to the doors and windows, and the interior is attractive and easily kept clean. The engine and boiler rooms are 83 feet long and 32 feet and 38 feet wide, respectively, the latter being of somewhat greater height to accommodate the vertical boilers. The north end of the boiler room is divided off by permanent fireproof partion to form a separate pump room free from the dust incident to stoking. The ceiling of this pump room is of reinforced concrete, resting on a steel frame, which supports the induced draft plant.

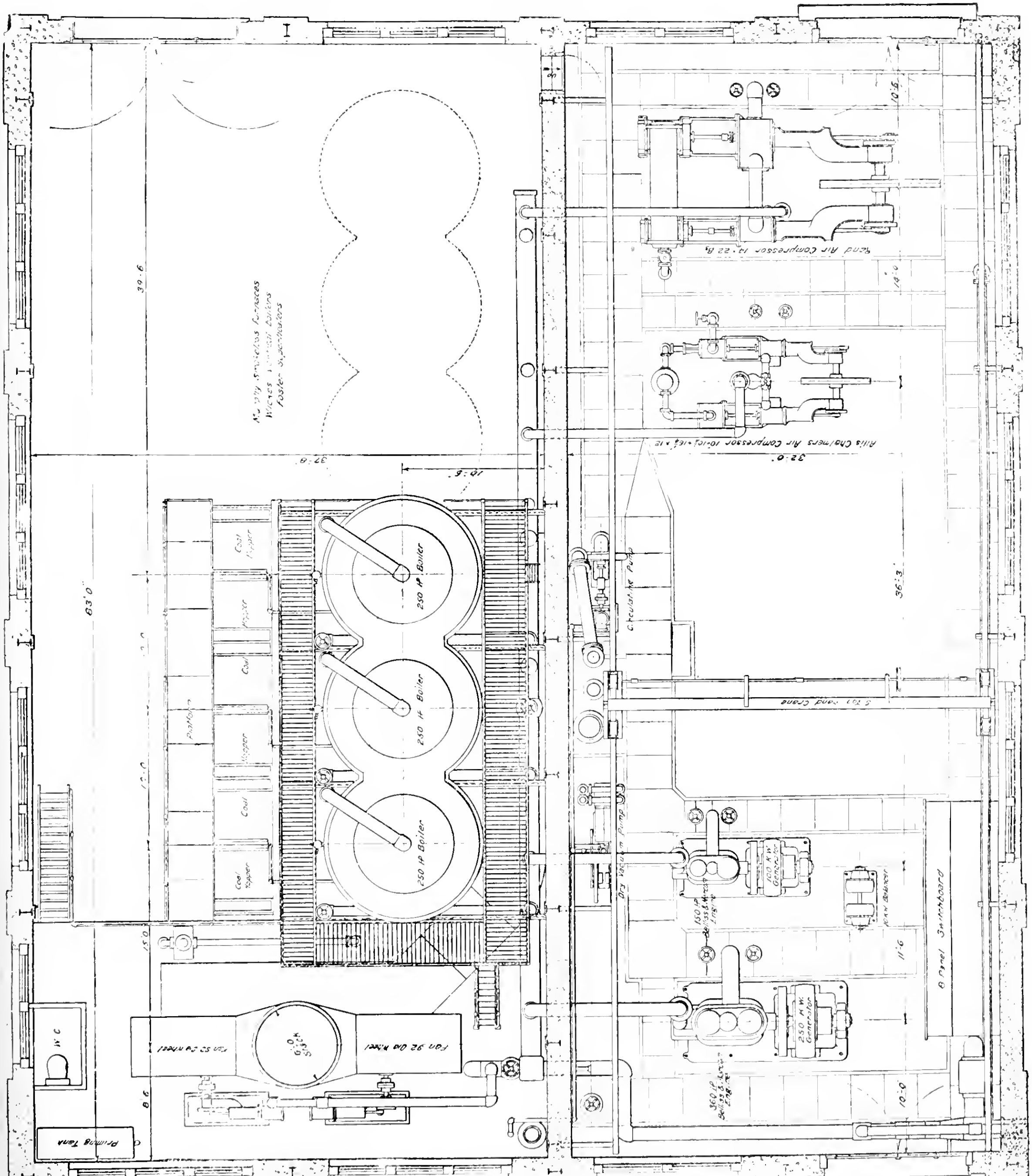
The equipment for any given power plant should be such as will produce the required power, light, and heat at a minimum cost. The type of apparatus by which this result can in each case be best secured will depend on local conditions. These should, therefore, be carefully taken into account. This is a point which is often overlooked, and the equipment is in many cases not suited to the special work which the plant is called upon to do. The most important elements involved, besides the amount of power required, are the length of the working day, the cost of coal and water, the amount of steam required for heating and other purposes, and the length of the winter season.

In the Kingston works there is little night work, a considerable amount of exhaust steam is required for heating, and the winters are long and severe. The cost of coal is not excessive, and there is plenty of river water available for boiler feed and condensing purposes. Under these conditions, the lowest cost for fixed charges and operation will be obtained by apparatus simpler and less expensive than that which would be proper in a large city central power plant. The efficiency will, of course, be somewhat less than that obtained in the large plants with 24-hour service, which have no use for the exhaust steam. It is believed that both the boilers and engines and auxiliaries, as well as the general layout, are in accordance with the above principles. The engines especially combine moderate first cost with a very low steam consumption, while the boiler efficiency is excellent without excessive first cost.

The equipment may be summarized as follows:

The boiler plant consists of three Wickes boilers, with Foster superheaters and Murphy stokers, and a Buffalo Forge Company induced draft plant. The pump room contains the Webster feed water heater, separate pumps (in duplicate) for boiler service and general shop supply, and a large fire pump.

In the engine room there are two Belliss and Mor-



Kingston Locomotive Works. —Diagram of Boiler Room and Power Plant.

com engines direct connected to Westinghouse generators, two air compressors, and a Worthington barometric condenser connected with both engines and compressors. The room also contains a balancer set and the switchboard, and is served by a 5-ton hand-power travelling crane. There is sufficient floor space to permit of the installation in the future of three more vertical boilers, an additional engine of somewhat greater capacity than the larger of those now in place, and another compressor.

The boilers are of the Wickes vertical water tube type, designed for a pressure of 150 pounds per square inch. The rated capacity of each is 250 horse-power, with a water heating surface of 2,510 square feet, and a grate surface of 42 square feet, so that the ratio of water heating surafce to grate surface is 60. These boilers consist essentially of two drums, connected by vertical tubes. The drums are 78 inches in diameter, the lower, or mud drum, being 53 inches long, and the upper, or steam drum, 100 inches. There are 112 four-inch tubes. The upper drum has a well-stayed head with one large manhole and a smaller hole directly over each tube, the latter to enable tubes to be readily inserted or withdrawn. From the inside of this large drum the tubes can be readily inspected and expanded when renewals are made.

The boilers are fitted with Foster superheaters of sufficient capacity to give 150° F. superheat. They are fastened to the front of the boilers just below the steam drum, the superheated steam pipe passing between two adjacent boilers to reach the main header.

The Wickes boiler having no combustion chamber immediately below the boiler, requires the addition of an exterior furnace or Dutch oven. This was utilized for the installation of Murphy stokers. The magazines are at present filled from above by an air hoist travelling on a runaway over the stokers, but a light trestle extending to the out-door coal pile is to be substituted, permitting small dump cars to run directly over the stoker magazines.

The induced draft plant is in duplicate, each half being able to supply draft very easily for the three boilers now installed, while the two fans are of sufficient capacity to handle six boilers at moderate speed. The fans are 92 inches in diameter, connected with 7″x 12″ horizontal engines. A somewhat novel feature are the concrete foundations, about 18 inches high, supporting the fan engines and absorbing the vibrations very fully.

The pump room contains one 12″x7″x1″ Blake duplex outside-packed boiler feed pump, and one 7½″x 5″x6″ Worthington boiler feed pump; also one 10″x 7″x12″ Northey duplex water service pump, and one 16″x 9″x12″ Northey fire pump, with priming tank. In the pump room is also located the 1,500 H.P. Class E. C. Webster star vacuum feed water heater.

The condensing plant was built by the John MacDougall Caledonian Iron Works, of Montreal. It consists of a Worthington ejector condenser, with cast iron discharge pipe and entrainer, supplied by an 8-inch Worthington circulating involute pump driven by a Robb engine. The condensing plant is designed to be of sufficient capacity for the power plant, as enlarged in the future to the full capacity of the building. The exhaust riser is 20 inches in diameter, the condenser tail pipe 10½ inches in diameter. There is also a Knowles 6″x 12″x10″ air pump. Both pumps are steam driven and located in the engine room, as shown in plan.

The engines are of the vertical quick-revolution type, built by Messrs. Bellis & Morcom, of Birmingham, England, and were erected by Messrs. Laurie & Lamb, of Montreal. They are cross compound, double crank, two-cylinder, vertical, enclosed double-acting self-lubricating engines. The larger unit has a capacity of 365 B.H.P. at 350 R.P.M. The diameter of the high pressure cylinder is 15 inches, and that of the low pressure 24 inches, with an 11-inch stroke. The smaller unit is of 145 B.H.P. capacity at 475 R.P.M The high and low pressure cylinders are of 10″ and 16″ diameter, respectively, with an 8-inch stroke. The large number of revolutions permits the use of light and economical generators, and reduces the floor space occupied by the unit to a minimum. For the larger engine the floor space occupied by the set is 13′ 6″x6′, and the extreme height 10′ 3″. For the smaller unit the floor space required is only 10′ 9″x4′ 6″, with a maximum height of 8′ 1″. It should be noted, too, that notwithstanding the large number of revolutions per minute, the piston speed is quite moderate, being 642″ for the 365-H.P., and 633″ for the 145-H.P. engine, a speed hardly in excess of that in so-called slow-speed engines.

There is a system of forced lubrication by which the oil is drawn from the reservoir by means of a force pump driven from an eccentric on the main shaft, and distributed under a pressure of 15 to 20 pounds per square inch. The engines are designed to operate successfully with steam superheated 150° F. The governors are of the centrifugal type, controlling an equilibrium steam throttle valve, connected directly to the high pressure steam chest. The frames of the engines are of an extremely massive character, reducing the vibrations to a very small amount, even with the high speed used. Their performance in actual service has so far been very satisfactory.

A series of tests were made at the builders' works to determine the steam consumption of the engines under various loads, and when operated both condensing and non-condensing. The following is a summary of these tests of the Bellis & Morcom engines, witnessed by the purchaser's engineer:

Engine Tests.

365 B. H. P Engine:

	Steam Pressure lbs. per sq. in.	Super-heat	Vacuum inches	Efficiency	Steam consumption, per B.H.P.	Steam consumption per I.H.P.
Full load, condensing	153 lbs.	141° F.	25.2″	92.3	15.1 lbs.	13.94
Half " "	147 "	71° F	24.5″	90.6	19.3 "	17.48
Full load, non-condensing	154 "	130° F	0	91.9	18.4 "	16.90
Half " " "	155 "	64° F.	0	89.2	23.8 "	21.23

145 B. H. P. Engine:

	Steam Pressure lbs. per sq. in.	Super-heat	Vacuum inches	Efficiency	Steam consumption, per B.H.P.	Steam consumption per I.H.P.
Full load, condensing	157 lbs.	159° F.	24.5″	92.5	15.3 lbs.	14.15
Half " "	163 "	116° F.	26.2″	90.5	16.5 "	14.93
Full load, non-condensing	163 "	172° F.	0	91.8	17.4 "	15.97
Half " "	159 "	194° F	0	90.3	20.1 "	18.15

N.B.- Efficiency is the ratio of Brake H.P. to indicator

The generators were built by the Canadian Westinghouse Company, at Hamilton, Ont. They are direct connected to the engines, and mounted on a common base. The capacity of the units is 250 kilowatts and 100 kilowatts, respectively. They are compound wound for 240 volts, and are of the Westinghouse Standard make in other respects.

The switchboard was built by the Westinghouse Company. It is Vermont marble, and contains three gener-

ator panels, one lighting panel and balancer set panel, and one total light-measuring panel; one power panel, with circuit breakers, and one total power-measuring panel. Recording watt meters of General Electric make, and Westinghouse registering ammeters, are used on the power and light totalling panels.

There are two air compressors. One of them is of the Ingersoll-Sergeant type, built by the Allis-Chalmers Company; has duplex steam cylinders, 10″ diameter, and two stage air compression cylinders 10¼″ and 16¼″. The stroke is 12″. Its capacity is 444 cubic feet of free air per minute. The second compressor was built by the Canadian Rand Company. It is compounded for both steam and air. It has a stroke of 22″, with high and low pressure steam cylinders 14″ and 24″, and air cylinders 14″ and 22″, respectively. The normal speed is 105 R.P.M., and its capacity at this speed is 1,209 cubic feet of free air per minute.

The steam piping is somewhat elaborate, as it was desired to utilize the exhaust steam as fully as possible at all times, while interfering as little as possible with the use of the condenser. An exhaust main was therefore laid along both the east and west walls of the engine room and connected by transverse pipes with each engine and compressor. One of these mains leads to the condenser, while the other connects with the heating system and the free exhaust. By operating valves attached to indicator standards just above the floor, the exhaust from each engine and compressor can be turned into the condensing system or utilized for heating. Even in very cold weather the exhaust from the auxiliaries and the compressors has generally proved sufficient for heating purposes, while during the spring and autumn months, when only a small amount of heat is required, almost all the units remain connected with the condenser.

With the co-operation of Professors Gill and Willhofft, of Queen's University Kingston, and their students, careful tests of the boilers and of the entire plant were made by Mr. C. J. Goldmark, E.E. The object of these tests was to determine the efficiency and economy of the plant under the conditions of actual operation. These tests may be briefly summarized:

Boiler Test.

Duration, 10 hours	Object, economy.
Water heating surface	2,500 square feet.
Grate surface	42 square feet.
Murphy stokers.	

Fuel—

Kind of coal	Yougheogheny Stock.
Thermal value of dry coal	13133 B.T.U.
Percentage of moisture in coal	.5%
Per cent. of ash and refuse to dry coal	12.6%
Dry coal per sq. ft. grate surface p.hr.	24.8 lbs.

Draft and Temperature—

Draft in furnace	0.264 inch
Flue gas average temperature	530° F.

Water and Steam—

Average temperature of feed water	66.8° F.
Average steam pressure (gauge)	146. 8 lbs. per sq. in.

Superheating—

Average temperature of steam	523.5° F.
Average amount of superheat	159.5° F.

Economic Evaporation—

Water evaporated per lb. of dry coal	8.07 lbs.
Evaporation from and at 212° per lb. of dry coal corrected for quality of steam	10.42 lbs.
Evaporation from and at 212° per lb. of combustible corrected for quality of steam	11.93 lbs.

Horse Power—

Rated H.P. of boiler (10 sq. ft. heating surface = 1 H.P.)	250 H.P.
H.P. developed by boiler	292.6 H.P.
H.P. equivalent of boiler and superheater	314.8 H.P.
H.P. in excess of rating 64.8 =	25.9%
Efficiency of boiler and furnace	76.6%

Economy Test of Station.

Duration, 11 hours.

Larger Belliss & Morcom engine (365 B.H.P.) and 250 kilowatt generator running; also Rand compressor. Both running condensing. Two boilers fired.

N.B.—The plant was not complete. There was no lagging on the steam pipes. There was no superheat at the air compressor, and only 40° F. at the large engine. The average load factor on the plant during the test was about 45 per cent. The average efficiency of the engine and generator was 86.5 per cent.

Steam used per I.H.P. per hour, including auxiliaries	28 lbs.
Net (omitting auxiliaries)	23.2 lbs.
Percentage of total steam used by auxiliaries	14.6%
Dry coal per I.P.H. per hour, including auxiliaries	3.24 lbs.
Dry coal per I.P.H. per hour, net corrected for drips	2.67 lbs.
Evaporatino from and at 212° F. per lb. of dry coal	10.27 lbs.
Thermal value of fuel	13133 B.T.U.

The live steam, exhaust, and compressed air pipes from the power house to the different shops are housed in by a wooden covering and supported on a structural steel trestle, which also carries the electric circuits. All heating is done by direct radiation, except in the machine shop, where a fan blower, driven by an electric motor, has been installed. All steam for heating is distributed at low pressure, exhaust steam being used whenever possible. The water of condensation flows by gravity to three receivers placed in pits below floor level, and is returned to the boiler plant by Bundy pumping traps. These traps are operated by live steam from the central plant, are simple and automatic in their action, and give good satisfaction. They enable the returns to be carried on the trestle, avoiding the difficulties of underground work.

The power distribution is at 240 volts on a two-wire system, while the lighting is taken care of by separate three-wire circuits—240—120 volts. Cooper-Hewitt mercury vapor lamps are used in the machine shop, foundry and boiler shop; arcs and incandescents in the other shops The mercury lamps have been very satisfactory as to illumination and economy. The light is very uniformly diffused, and there is an almost total lack of sharply defined shadows. All wiring is run in iron conduits, with iron panel boxes with enclosed fuses.

The motors are of Westinghouse make, and are for direct current at 240 volts. Excepting a number of the large machine tools, which are fitted with individual compound-wound motors, the plant is arranged in group drives, with shunt-wound motors. There are some series motors on the cranes and elevators. The total horse power of the motors now installed is 821 H.P., in sizes varying from 6 to 60 H.P., and speeds from 500 to 1675 R.P.M. Each motor is controlled from a slate panel with circuit breaker, switch and enclosed fuses. The power plant was installed under the direction of Mr. Chas. J. Goldmark, who is also responsible for the electric layout and the details of the power house equipment.

Mr. J. E. Hughes, of Inverness, N.S., has been figuring on putting in a small plant for lighting the town.

TELEPHONE TOPICS

Expense Economies for Telephone Companies.

A paper was presented by Clarence S. Moore, upon "The Most Important Points in Economizing Expense" at a meeting of the Corn Belt Telephone Workers, Waterloo, Iowa, recently. The following is an abstract of his address:

Instead of taking the three most important points in economizing expense, we will enumerate the three different kinds of expense and the different ways they may be reduced to a minimum, at the same time keeping our equipment and service at its best. The three different kinds of expense met with in the telephone business are: Operation, maintenance and construction.

Operation.—One important expense under this heading is that incurred in the collecting from patrons for service rendered by the telephone company. This expense may be reduced in several ways. All rural patrons should be encouraged to pay their telephone rent twelve months in advance, thereby saving the expense of a collector's time, as well as the cost of stationery and postage used in sending delinquent notices. City patrons should also be educated to pay in advance at least a month, and more if possible. One of the local managers at one of our larger exchanges has succeeded in getting his city subscribers to pay quarterly in advance, and by so doing has reduced the expense of collecting at least one-fourth of what it was when they paid monthly, and enabling the company to meet its obligations more promptly. When a company can pay cash for material purchased it is able to get better terms than when the bill is paid a year afterward.

Maintenance.—The two most important things to remember in the reduction of maintenance expenses are: First, the permanent clearance of trouble; second, the co-operation of the subscriber, especially the rural subscriber, with the troubleman in the clearing of trouble. The troubleman who drives out in the country six miles, shakes out a cross, and drives back to town again is an expensive man to the company, because the next hard wind will blow this same cross back in, and the troubleman will again spend his time and possibly some of the company's money for livery, in again clearing a case of trouble, which could as well as not have been cleared permanently on his first trip, had he taken the pains to draw up the slack in the wires. Furthermore, these repeated cases of trouble cause disatisfaction among subscribers, and that in the end means loss of revenue to the company, especially if there is opposition in that particular territory. If the trouble occurs on long-distance lines, these lines are put out of commission and long-distance revenue is lost. By all means teach your rural patrons and those living at a distance to bring their defective telephone, receivers, mouth pieces, batteries, etc., to your shop for repairs. Teach them also how to clean out lightning arresters. They can save you miles of driving and lots of time. But, while instructing them, be sure and impress upon them the importance of leaving the more delicate parts of the machine alone, or they may cause you far more trouble than they clear.

Construction.—In building new lines or leads and in putting in new cable, we should consider that every dollar saved in using good second-hand material is a dollar earned, and where a certain amount of money is allowed for a certain job that job can be made more complete than if the old material was junked and new had to be purchased to take its place. Slim poles can be used on the average lead where the lead is straight, and if the bottoms of the longer poles have rotted, the tops can be sawed off and used on light farm leads. When the bottoms of the shorter poles have rotted, they can be sawed off and used for guy stubs. Six-pin cross-arms can readily be made out of ten-pin cross-arms which have rotten ends, by sawing off the bad ends and by re-pinning and nailing the pins in the arms.

In rebuilding an exchange the local lines on the old poles can be untied and the wires tied temporarily to the pins. The insulators can then be removed and transferred to the new poles, thus saving the expense of buying new ones. In installing cable all old cable should be thoroughly tested and if found good should be used. The short pieces can be used for the laterals.

Some of the foregoing economies may seem of little importance at a glance, but if every manager were able to reduce the expense ten cents per year for each subscriber he has, the company of any considerable size at the end of the year would have several hundred more in its treasury than it would otherwise and this would pay the interest at 6 per cent. for an entire year on a goodly amount of stock.

Long Distance Economies.

"The Most Important Features of the Long-Distance Business" was the subject of a paper read before the same meeting by Mr. H. M. Pierson. The following is an abstract of Mr. Pierson's remarks:

"There are so many important and interesting features connected with the long-distance business, that I hardly know which are the most important. I will begin with service, as I think this one of the most important.

"In the first place a lineman or troubleman who looks after long-distance lines should be a fairly good man, and one who understands how to use the test set and his head. At least one-half of long-distance trouble shooting is to get a good test. I will give an example. The most important line we had at the exchange I was working at this time was reported crossed with a farm line which paralleled the long-distance line for a distance of 15 miles. The trouble was reported to me Friday morning by the wire chief. I started at once, which is what a long-distance troubleman must do if he "makes good." Of course I was looking for a cross I went over the lines the 15 miles without finding the trouble. I called for a test, with the same result: I still had a cross. I told the wire chief that I was sure the lines were not crossed, but that the long-distance line was grounded. The wire chief then informed me that I was to look for a cross, and that he knew what he was doing. Well, I worked all day Friday, Saturday and Sunday, looking for a cross, and when I found the cross it was a ground on the long-distance line. The cross-talk which lead the wire chief to believe the line was crossed will occur on any long-distance line which has a ground on one side. If the wire chief had tested the line, instead of saying it was a cross all the time, we would have had the line clear two days and a half earlier.

"A great part of the conduct of long-distance business is dependent upon the operator. There are operators who, after they have put in a call for a party, if the

the line for 30 minutes and bother two or three operators station called cannot get the party at once, will hold along the line for the same length of time. They honestly think that they can get the called party to the telephone more quickly than can the operator at the station called. This is wrong. An operator who has 30 minutes' time to hang on a line has more time than most operators, and is surely neglecting some part of her own work.

"An operator should be quick to answer, quick to take the call, quick to get the party up, and if she cannot get the party at once, she should call when she can. If the operator called tells the operator calling that the party called is out of town, this should be enough to stop with, and the line should not be held any longer. If two parties are on the line and both of them are saying 'Hello' at the same time, and both with a weak voice, the operator can, with a little effort and a strong voice, say 'Hello, Brown, Hello, Smith, there is your party; talk up now,' and nine times out of ten they will talk. If it takes over five minutes to repeat a call it is better to lose the call."

Unfilled Demands Piling Up.

With manufacturers of various articles of trade putting on more hands, railways ordering new equipment, and everyone feeling that fundamental conditions are sound and safe, there is good reason to believe that within a few weeks a renewal of business activity will become more and more apparent, says "Telephony." Already very hopeful signs may be observed in the telephone field. It is generally agreed that an unfilled demand for service has been gradually piling up. Companies which were amply supplied with funds at the beginning of the depression have been able to fill cables and additional switchboard capacity as it was installed, and others now in the market for supplies anticipate prompt and good returns on new investment. Securities of well managed telephone companies have come out of the panic in far better repute than they have ever been, on account of the admirable showing they have made in comparison with those of other corporations. Prices on material are so low as to offer exceptional inducements to early buyers. All things considered, there is reason to believe that the telephone industry will be one of the first to profit by the general resumption of business which is everywhere admitted to be developing.

Trade Enquiries.

The Dominion Government Trade and Commerce reports contain the following trade enquiries. Readers of the "Electrical News" may obtain the names of enquirers by writing us, enclosing stamped envelope and stating number of enquiry:

1684. Agent.—A French firm of manufacturing mechanics would like to get in touch with a Canadian agent dealing in engineers' supplies.

1690. Agent.—A Parisian firm is prepared to appoint an agent in Canada to sell sectional papers for architects, engineers and designers.

1775. Copper ingots.—A Manchester firm desires to obtain prices of copper ingots from Canadian exporters.

The City Solicitor of Toronto has informed Secretary McGowan of the Fire Department that the city has no power to interfere with the erection of electric light poles in different parts of the city.

Miscellaneous Notes

At the second meeting of the Nova Scotia Telephone Society, recently formed, Mr. J. C. Mitchell gave an address on "Local Battery Bridging Telephone." H. H. Williamson also addressed the meeting and a general discussion followed. The officers of the new society are: L. A. Dolan, President; H. H. Williamson, Vice-President, and F. C. Bowes, Secretary-Treasurer.

At a recent meeting of the shareholders of the Yarmouth Telephone Company it was decided to sell out to the Nova Scotia Company, and the transfer has already been made. The result of this as far as the public is concerned will be to give the Yarmouth Exchange a somewhat larger free service radius and a toll service to all points on the south-west shore, it being the intention to rebuild the line in the early spring and bring everything up-to-date.

The Site Committee of the Bell Memorial Association announce that the former homestead of Alexander Graham Bell, the inventor of the Bell telephone, on Tutela Heights, near Brantford, Ont., where the telephone was invented, will be acquired as part of the memorial scheme. In addition a $25,000 monument will be erected in the city and unveiled, probably in the summer of 1910.

The rural telephone system recently established in the municipality of Wallace, Man., consists of about 300 subscribers, has 300 miles of installation, and is connected with the Government exchange at Elkhorn and Virden, and operated by the Government. C. E. Ivens is reeve of the municipality and James F. C. Menlove is the manager and secretary-treasurer.

First Sod Turned for Ontario Power Commission.

The ceremony of turning the first sod on the Ontario Government's Power Transmission System, of 293 miles of line, was performed at the Canadian National Exhibition Park, Toronto, on Nov. 18th. Honorable Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, presided, and the sod was turned by Ald. J. H. Fryer, of Galt, president of the Western Ontario Municipalities Power Union. The sod was turned with a silver spade, bearing an inscription relative to the occasion. Addresses were given by Hon. Mr. Beck, Mr. Fryer, Secretary J. W. Lyon, of the Power Union; Mayor Oliver of Toronto; Mr. P. W. Ellis, Toronto; W. K. McNaught, M.P.P., Toronto, and Sir James P. Whitney. Sir James Whitney in his speech declared that it was the intention of the Government to carry the power policy to the fullest completion. The spot upon which the ceremony took place will be marked with a tablet to commemorate the event.

The City Council of Port Arthur are reported to have cancelled their agreement with the Kaministiquia Power Company, by which they were to have taken 400 horse power for a period of ten years. It is alleged that the company, immediately upon securing the agreement, endeavored to use it in their negotiations with the Ontario Government for the Dog Lake power rights. The city is also endeavoring to obtain the same rights, and the Council allege that it was specially understood when the agreement was made that it was not to interfere with the city's rights in the Dog Lake matter.

Current News and Notes

Boissevain, Man.
The building in which will be installed the town electric light plant is now being erected on the site of the old power house.

Brandon, Man.
The Telephone Commission are stated to be preparing for a considerable amount of long distance work next year.

Belleville, Ont.
The erection of dams to regulate the flow of water in the Moira river, which empties into the Bay of Quinte, was recently asked by a deputation from Hastings County, which waited on Hon. Frank Cochrane, the Minister of Lands, Forests and Mines. The delegation said that it was estimated that an expenditure of about $35,000 would ensure a supply of 22,000 horse-power of energy continuously. This, it was said, would provide electricity for Belleville, Tweed, Madoc and other towns, and also to the mining industry in the county. The deputation included Town Solicitor Mikel, of Belleville; Henry Corby, ex-M.P.; J. W. Pearce, M.P.P.; J. M. Johnston, M.P.P., and Amos Richardson, M.P.P., the members of the legislature for Hastings County.

Charlottetown, P. E. I.
Tenders have been called by Mr. McKenzie, Chief Engineer of the Intercolonial Railway, for the electrical equipment of the Prince Edward Island Railway's new power house, to consist of a 75 k.w. direct current generator with potential of 230 volts, direct connected to and mounted on same base with engine. We are informed that the specifications for the set are very stiff and that the generator must be controlled so that a variation of as much as 2 per cent. will not occur.

Dundas, Ont.
The Northern Electric & Manufacturing Company have obtained the contract for the fire alarm system.

Dunnville, Ont.
The ratepayers will vote on December 3rd on a by-law to issue $15,000 4 per cent. 20-year debentures as a bonus to the Dunnville, Wellandport and Beamsville electric railway.

Dublin, Ont.
The McKillop, Logan & Hibbert Telephone Company, Limited, has been incorporated with a share capital of $15,000. The incorporators include Albert Michell, Dublin, Ont.; W. W. Sadler, J. Norris, David Bruce and H. W. Templeman, all of Hibbert Township.

Edmonton, Alta.
The City Electric Light and Power Department are now figuring upon the supply of light and power to four of the coal mines in the eastern end of the city. The mines are those of the Standard Coal Company, the two Franks and the Edmonton mine.

Glencoe, Ont.
The ratepayers voted recently on a by-law to issue $11,000 5 per cent. 15 years electric light debentures. Geo. Wilson is Village Clerk.

Glace Bay, N. S.
The local authorities are installing 400 meters in connection with the municipal electric light plant and are also adding about three miles of transmission lines to the system.

Hamilton, Ont.
The purchase of the electric pumps and motors by the city has been deferred until the settlement of the power by-law suit which will be heard on November 30th.

Halifax, N.S.
It is proposed to instal electrical apparatus at the County Academy at a cost of $1,500.

The Wentworth Home Telephone Company have been granted a franchise to erect about 35 miles of teelphone lines in Wentworth County.

The Nova Scotia Steel & Coal Company, Limited are progressing rapidly with the development of their Wabana mine. They will install machinery shortly, and are figuring on an engine driven generator of about 500 k.w.

Inverness, N. S.
J. E. Hughes, of Inverness, has been figuring on putting in a small plant for lighting the town.

Mr. W. D. Barclay, manager of the Inverness Railway & Coal Company, is considering the installation of a new electric plant for furnishing light for their mine at Inverness and also supplying about 1,000 lights to the town. If the company decide to install this plant, which will be steam driven, they will require about 80 or more arc lamps. They would run a 3-phase, 60-cycle circuit, and there is every reason to believe that the proposition will go through shortly.

Kelowna, B. C.
The Hinton Electric Company, Vancouver, are installing a $40,000 electric light plant in this town.

Ladysmith, B.C.
The city authorities have received definite information that the C. P. R. will not take up the city electric light debentures. The Council, however, are now engaged in passing a new sewerage by-law which will require a loan of $50,000. This by-law will shortly be presented to the ratepayers and if it carries the bonds for both the electric and sewerage systems will be offered in bulk.

London, Ont.
It is stated that the Independent Telephone Company of the United States will shortly make an application for a franchise in this city. They expect to have trunk lines constructed as far as Brantford within a year, when they will be in a position to continue the line to London.

The Southwestern Traction Company have asked the City Council for permission to extend their tracks along Simcoe to Talbot, and it is stated that the new St. Mary's Traction Company will apply for a charter to run on Talbot street, in which case connection would be made between St. Mary's and other northern points and St. Thomas.

Morrisburg, Ont.
A project is under way to connect this town with Ottawa by an electric railway. The proposal is to build a line from Morrisburg to a point on the New York & Ottawa Railway, which extends from Ottawa to Cornwall, and to utilize about 20 miles of the New York & Ottawa line from Russel village to Ottawa. Hiram Lockridge, Morewood, Ont., is interested.

Macleod, Man.
A bylaw will be submitted to the ratepayers on December 4th to issue debentures amounting to $35,000 for improving the power plant.

Moose Jaw, Sask.
Bylaws to issue $40,000 40-year 5 per cent. sewer debentures and $30,000 waterworks debentures, will be voted on by the ratepayers on November 28th. John B. Simpson is Secretary-Treasurer.

Mount Forest, Ont.
The Mount Forest, Wellington & Grey Telephone Company, Limited, has been incorporated with a share capital of $10,000. The incorporators include R. O. Kilgour, J. J. Cook, both of Mount Forest, W. H. Wallace and J. R. Philp, both of Egremont Township.

Montreal, Que.
The Montreal harbor engineer is now preparing plans for an electric power plant on the harbor front to supply all the power required along the harbor. Plans for a drydock are also being prepared, and for a concrete wall around the piers to prevent wearing.

It is announced that the Montreal Light, Heat and Power Company contemplate the construction of an additional steam plant whose maximum will equal 100,000 horsepower. The Montreal Light, Heat and Power Company have at the present time contracts which call for no less than 70,000 horse power, the supply being obtained as follows: Lachine, 10,000, with $5,000 to be added next year; Chambly, 20,000; Shawinigan, 20,000, and Soulanges, 15,000, or a total of 60,000 horse-power. It is hoped to contemplate the present project within two years.

Okotoks, Alta.
The Electric Light Company are putting up a new building and installing $10,000 worth of new machinery.

Port Arthur, Ont.
The ratepayers voted on November 19th on a by-law to issue $12,000 5 per cent. debentures for the purpose of completing the Current River water power development works. J. McTeigue is City Clerk.

General dissatisfaction is in evidence with regard to the present lighting system in this city, and it is stated that unless the authorities make the necessary improvements a large number of the local merchants will instal their own electric lighting plants.

The ratepayers have approved a bylaw to raise $27,000 for the Onion Lake dam, also a measure for the construction of a reservoir dam on Current river.

Port Colborne, Ont.
Mr. E. F. Seixas, general manager of the N., St. C. & T. Electric Railway, and a party of prominent railway men were in town recently. They had driven over the route of the proposed belt line railway around the Niagara district, starting at Niagara Falls, and from there to Fort

Erie, then from Fort Erie to Port Colborne. From here they drove to Welland. This is stated to be the route that will be covered by an electric line in the near future.

Russell, Man.
The capital of the Russell Telephone Company has been increased from $5,000 to $25,000, the proceeds to be used for the construction of a number of extensions.

Sault Ste. Marie, Ont.
The Lake Superior Power Company are making plans for the construction of a hydro-electric plant with an output of 6,300 horse-power, the cost of which is estimated at $110,000. L. H. Davis is chief engineer.

Seeley's Bay, Ont.
The Leeds Rural Telephone Company have decided to extend their lines into Pittsburg, Ont.

Sydney, C. B.
The Dominion Iron & Steel Company, Limited, and the Nova Scotia Steel & Coal Company, Limited, are stated to be contemplating the installation of steam turbine plants. John Preston, mechanical engineer of the Nova Scotia Steel & Coal Company, who has just returned from a tour of the large eastern cities of the United States, has reported in favor of the installation of a turbo-generator at Sydney Mines and it is expected that this will be put in at once. The other companies will probably add turbo-generators to their plants in the spring.

Saskatoon, Sask.
The ratepayers have approved a bylaw to raise $30,000 for extension to the electric light plant.

St. Thomas, Ont.
The City Council have asked their engineer to prepare estimates of the cost of certain extensions to the lines of the street railway company.

Sydney, N. S.
At a meeting of the Marine and General Engineering Company, the directors outlined plans for the future and decided to install power shortly in their plant on King's road.

St. Catharines, Ont.
The City Council have concluded negotiations with the Lincoln Electric Company for a five year contract for the lighting of the city streets at $50 per arc light, the city agreeing to take not less than one hundred lights after January 1st, 1910. The city has the power to renew the agreement at the expiration of the contract for a period of fifteen years. A clause inserted in the agreement giving power to the company to transfer or assign the agreement and the contract to the Cataract Company was struck out before adoption.

Trenton, Ont.
A large water power development is planned by the Electric and Water Power Company. J. J. Wright, of Toronto, is manager.

Tangier, N. S.
The Dominion Mining Company are making extensive improvements at their mine. They have recently placed an order for a large compound duplex air compressor, of the belt driven type, with the Ingersoll-Sergeant Company of Canada, Limited. This machine will have a capacity of about 1,000 cubic feet, and will be belted to an electric motor. The company will install a hydro-electric plant near the mine. The water turbine will be about 600 h.p., and will operate under a head of 18 feet. The current will be used to drive the compressor, hoist and mill. Mr. L. B. Dow, of Boston, is the consulting engineer for the company.

Toronto, Ont.
Tenders addressed to the Hon. Adam Beck, Chairman of the Hydro Electric Power Commission, will be received until December 15th for the manufacture and delivery of 15,000 high tension insulators for operation on the Commission's 110,000 volt transmission lines. Plans and specifications may be obtained at the office of the Commission, Continental Life Building, this city.

Vancouver, B. C.
It is stated that revised plans for the B. C. E. R.'s projected improvements at Lake Buntzen, have been completed. The electrical units to be installed will be equal to 52,000 horse power. In addition, extensive tunnel work is involved, also the construction of a large dam.

Mr. Robert Howes recently arrived in the city to take up an important position with the British Columbia 'Electric Railway Company. He will take charge of the branch line of the company to Chilliwack. It is stated that the B. C. E. R. do not propose to permanently fill the position of general superintendent. Mr. Woodroofe is at present acting in this capacity.

Winnipeg, Man.
Tenders were received by the Telephone Commission until November 21st for the supply of approximately 25,000 telephone poles for use in the Province of Manitoba. Further particulars on application.

The City Council has decided to go ahead with the building of a telephone line along the line of the new municipal power railway, costing $7,000, also to erect a $3,000 residence for the engineer at the Winnipeg river power site. The whole power scheme will be vigorously pushed to completion.

Wolfville, N.S.
The citizens have voted an additional $20,000 to the sum of $20,000 previously voted for the construction of an electric light plant for this town.

Waterford, Ont.
The Swedish American Telephone Company will erect a plant for which the town recently passed a by-law to raise a loan of $10,000 and $1,000 for a free site.

Yarmouth, N. S.
The plant and franchise of the Yarmouth Telephone Company have been acquired by the Nova Scotia Telephone Company.

PERSONAL MENTION.

Mr. Charles Brandeis, C.E., Montreal, has purchased a house, 4 Phillips place, opposite the Engineers' Club, in order to provide for more office space. He will take possession of the new quarters on May 1st next.

Mr. A. S. Cooke, C.E., who for several years has been connected with the Cataract Power Company's interests and other work in the Niagara Peninsula, has been engaged by the Lincoln Paper Mills Company to install their new hydraulic power system at the old Lybster Cotton Mills, Merritton, Ont.

Mr. Thomas Wright, formerly with the Nova Scotia Telephone Company, who for the past two years has been at Port of Spain, Trinidad, as general manager of the telephone system there, arrived in Halifax recently and looked up old acquaintances. He was on a short visit to his father's home and friends.

Mr. W. F. Simmons, for seventeen years general superintendent of the Kingston Light and Power Company, of Kingston, Ont., and for the past four and a half years general superintendent of the Peekskill Lighting and Railroad Company, of Peekskill, N. Y., will represent R. W. Marshall and Company in the Dominion of Canada. He will immediately open offices in Toronto, with a view of following particularly the electric railway trade throughout the provinces.

Mr. R. G. Young has resigned his position as superintendent of the Utica and Mohawk Valley Railway Company, of Utica, N. Y., to become general manager of the Chatham, Wallaceburg and Lake Erie Railway Company, of Chatham, Ont. He has been connected with the Utica system for about twenty years, part of the time as superintendent of the Belt line and later as superintendent of construction for the Utica and Mohawk Valley Railway Company.

Mr. George Blanchard, the American street railway expert, and vice-president of the Dominion Power and Transmission Company, will remain in Hamilton and put the street railway system and other properties of the Dominion Company in good shape. The new car shops will be built this fall, and the reconstruction of the system begun early in the spring. Mr. Blanchard has already succeeded in smoothing over much of the trouble with the city, and there was considerable disappointment at the prospect of his leaving Hamilton.

In the New York metal market it was reported recently that there was a heavy demand coming from the electrical manufacturing companies for tin. This demand is said to be responsible for the advance in price both in the United States and Europe. The United States Steel Corporation is said to be buying tin in Singapore, and the market there has been advanced. The buying movement in copper which commenced early in October, has continued, resulting in a much better market than has prevailed for some time. It is estimated that October buying amounted to 100,000,000 pounds, which about balances the production. Indications point to heavy business in the near future and manufacturers are showing a desire to take advantage of low prices. There is a general buoyancy in the market and confidence that metal prices will advance.

The Dominion Board of Railway Commissioners have ordered the Toronto Electric Light Company to remove their poles on the Toronto Esplanade, which carry wires across the Grand Trunk Railway tracks from the Scott street plant. The Grand Trunk Railway Company had made a complaint respecting the danger from the presence of these wires, stating that one man had already been seriously injured and that another accident was liable to occur at any moment. The Electric Light Company claim that their wires had been there long before the tracks had been put in so close to the poles, and that to place them underground would involve a cost of about $62,000. In making the order the chairman of the Board stated that the work must be completed within four months, and that as to the cost the Board had no jurisdiction.

Adapter for Tungsten Lamps.

A useful device is the Benjamin Adjustable Plug Socket, the Tungsten lamp adapter as illustrated herewith, which enables one to use Tungsten lamps on any fixture, changes the position of lamps to the vertical, and by means of a rotating sleeve permits of attachment without a turning device. Benjamin Tungsten

Benjamin Tungsten Arc Cluster.

Benjamin Tungsten Lamp Adjuster.

arcs present a very pleasing appearance to the eye and combine a number of practical features. They are made in various forms, both in and out-door, ceiling and pendant, making it possible to meet any particular demand. A range of lamps varying from 40 to 100 watts is permissible. The Benjamin Tungsten arc with a cluster body, as illustrated herewith, has a special reflector shell of frosted aluminum, 15-inch stem of $\frac{3}{8}$-inch iron pipe and $\frac{3}{4}$-inch brass casing, reflector holder, 18-inch opal reflector, $5\frac{1}{2}$x4-inch canopy and crowfoot. The device is wired and measures 25 inches over all. The closed Tungsten arc is constructed along the same general lines, but has an additional enclosing globe which is spaced at the top and open at the bottom. This affords good ventilation and an opening for a suspending chain or cord. It also assists in rounding out the fixture, securing symmetry of outline.

By way of a Christmas novelty the Westinghouse Electrical & Manufacturing Company have prepared an attractive package wrapped in handsome holly paper and tied with red ribbon. Each package carries an appropriate card and label conveying the wishes of the season. The packages contain such articles as sewing machine motors, sad irons and electric hot plates or stoves.

The Allis-Chalmers-Bullock, Limited, have issued Bulletin No. 1612 on Hydraulic Turbine Governors. In view of the great interest now taken in hydro-lectric work this bulletin should prove of much interest to our readers. In connection with the bulletin the company claim that they are the only company in Canada which build hydro-electric plants.

The Nernst Lamp Company, Pittsburg, Pa., have issued an attractive booklet concerning the Westinghouse Nernst Multiple-Glower. Bulletin "B," as it is entitled, contains a number of attractive illustrations of these lamps and describes a number of their interesting and useful points. It also contains a price list of a great number of the company's various makes of lamps.

Great Western Railway of England

Industrial Sites

Sites suitable for the establishment of Factories and Works are available adjoining the Great Western Railway, within easy access of the principal ports, Coal and Iron fields, and Industrial centres.

Particulars of such sites and of the Company's arrangements for Siding Facilities, Conveyance Rates, etc., etc., may be obtained from the Chief Goods Manager, Mr. T H. Rendell, Paddington Station, London, W.

JAMES C. INGLES,
General Manager. 12

DO YOU WANT TO SELL
second-hand machinery of any kind? Many a central station manager has one or more machines for which he has no further use.

SOMEBODY WANTS TO BUY
just such machines. You can get in touch with that somebody by advertising in the "Wanted and For Sale" Column of the ELECTRICAL NEWS. The expense is trifling.

ESTABLISHED 1849.

BRADSTREET'S

Capital and Surplus, $1,500,000.

Offices Throughout the Civilized World.

Executive Offices:
Nos. 346 and 348 Broadway, NEW YORK CITY U.S A

THE BRADSTREET COMPANY gathers information that reflects the financial condition and the controlling circumstances of every seeker of mercantile credit. Its business may be defined as of the merchants, by the merchants, for the merchants. In procuring, verifying and promulgating information no effort is spared, and no reasonable expense considered too great, that the results may justify its claim as an authority on all matters affecting commercial affairs and mercantile credit. Its offices and connections have been steadily extended, and it furnishes information concerning mercantile persons throughout the civilized world.

Subscriptions are based on the service furnished, and are available only by reputable wholesale, jobbing and manufacturing concerns, and by responsible and worthy financial, judiciary and business corporations. Specific terms may be obtained by addressing the company or any of its offices. Correspondence invited.

THE BRADSTREET COMPANY.

OFFICES IN CANADA: Halifax, N.S ; Hamilton, Ont. ; London, Ont. ; Montreal. Que. ; Ottawa, Ont. ; Quebec, Que. ; St. John, N B ; Toronto, Ont. ; Vancouver, B.C. ; Winnipeg, Man. ; Calgary, Alta.

THOS C IRVING,
Gen. Man. Western Canada, Toronto.

Established 1882

THE COMMERCIAL

The WEEKLY FINANCIAL, COMMERCIAL & GENERAL TRADE NEWSPAPER of the GREAT WEST

Winnipeg, Manitoba

Business For Sale

Wiring, Fixture and Supply business for sale, good chance for electrician to get into business for himself; good city; will be on Niagara Power Line.

12 Box 104 ELECTRICAL NEWS, Toronto.

Technical Electrical Engineer

wishes position in Canada. At present Assistant Superintendent of Power over four sub-stations with American railway and lighting company. Excellent references.
Address Box 103.

11 CANADIAN ELECTRICAL NEWS, Toronto.

Hydro-Electric Power Commission.

Tenders for High Tension Insulators.

Tenders will be received up to 5 p.m. TUESDAY DECEMBER, 15TH, 1908, for the manufacture and delivery of Fifteen Thousand High Tension Insulators for operation on the Commission's 110,000 volt transmission lines, according to the plans and specifications to be obtained at the Commission's Office, Continental Life Building, Toronto.

Contractors are requested to bear in mind that tenders may not be considered unless made upon forms supplied with specifications.

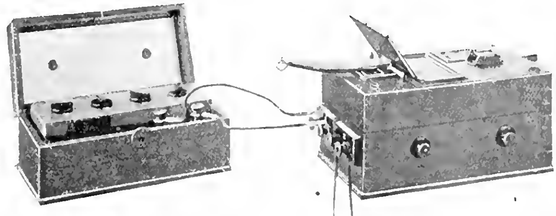
An accepted bank cheque for the sum of seven thousand five hundred dollars ($7,500) must accompany each tender, which sum will be forfeited, if the party tendering declines entering into a contract for the work, at rates stated in tender.

The lowest or any tender not necessarily accepted.

Tenders must be sealed and addressed to the Hon Adam Beck, Chairman of the Hydro-Electric Power Commission of Ontario, Toronto, Ont.

It is said that the Germans use a Black Cat for finding leaks.

J. F. B. VANDELEUR, 3 Dineen Building, TORONTO



Resistance Box.

Bridge Megger with Hand Generator.

Euershed's Bridge Megger and Resistance Box

Large Stock in Toronto

The Bridge Megger not only saves time and money, but does what no other instrument can do, that is:

It measures at 250 volts pressure from .01 up to 999900 ohms with resistance box, and at 500 volts up to 40 meghoms. All ranges up to 1000 volts, 2000 meghoms. in stock.

Contractors to the Admiralty and War Office.

Makers of **Inkless Recorders** of all types, **Wattmeters, Power Factor, Frequency, Booster, Earth, Portable, etc.**

Tramcar and Switchboard Types.

Portable Ammeters and Voltmeters for A. C. and D. C. combined.

Laboratory Instruments.

(See page 7.)

Publications.

"Electrical Illuminating Engineering," by William Edward Barrows, Jr., B.S., E.E., has been issued by the McGraw Publishing Company. The book is designed to fill the demand for a satisfactory text book on illuminating engineering. It had its origin in a set of notes compiled by the author for use in his classes and was extended in the hope that it might be of service to the profession generally. The book covers a number of interesting subjects, including photometry, standards of illuminating power, various classes of lamps, shades and reflectors, and concludes with a practical chapter upon illuminating calculations.

A book upon "Electric Motors," their installation, control, operation and maintenance, by Norman G. Meade, has been issued by the McGraw Publishing Company. It includes an explanation of the phenomena of electric motors, a description of the leading motors and appliances, and practical suggestions for installation, care and management for the use of practical men. Mathematics have been practically eliminated and illustrations and diagrams relied on as far as possible to convey the meaning intended. The suggestions contained in the book are based upon several years of personal experience with motors and auxiliary appliances and upon standard practice adopted by the leading electrical companies.

Honolulu has 170 miles of city streets; 26 miles of electric street railway, on which 50 cars are regularly operated; two electric light plants; one petroleum gas plant with capacity of one half million cubic feet per day, and a telephone service with 1,575 subscribers.

A. W. FABER'S "CASTELL" PENCILS

The Finest in Existence

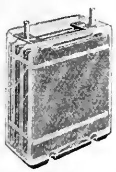
16 Degrees 6B to 8H

Unequaled for Purity, Smoothness, Durability or Grading

A. W. FABER'S "CASTELL" COPYING PENCIL

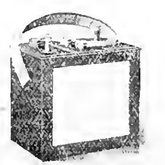
A. W. FABER
149 Queen Victoria St.,
LONDON, E. C.
Manufactory Established 1761

"Vulcan Accumulator"
Madigin Patents



Made in Canada

Established 1898



There are more than
SIX THOUSAND CELLS of

Vulcan Storage Batteries

Used in Canada To-day

TWO YEARS' GUARANTEE

Bulletins on Request

The
Croftan Storage Battery Co.
423-425 West Queen St. - TORONTO, CAN.

Montreal and East: JOHN FORMAN
Winnipeg: GASOLINE ENGINE SUPPLY CO.
Vancouver and West: SHIPYARD, LTD.

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

The New Weston Alternating Current Switchboard Ammeters and Voltmeters

will be found vastly superior in **accuracy, durability and workmanship** to any other instruments intended for the same service.

They are
ABSOLUTELY DEAD BEAT. EXTREMELY SENSITIVE. PRACTICALLY FREE FROM TEMPERATURE ERROR.

Their indications are
PRACTICALLY INDEPENDENT OF FREQUENCY AND ALSO OF WAVE FORM.

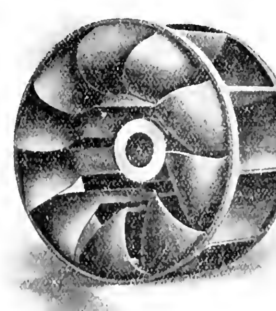
They require
EXTREMELY LITTLE POWER FOR OPERATION AND ARE VERY LOW IN PRICE.

Correspondence concerning these new Weston Instruments is solicited by the

Weston Electrical Instrument Co.
Waverly Park, Newark, N.J., U. S. A.

New York Office: **74 Cortlandt St.**

The "Canadian" Turbine Water Wheel



MANUFACTURED BY

Chas. Barber and Sons
Meaford, Ontario

Write for description, prices and references

Electrical Contracts Awarded.

Charlottetown, P. E. I.

The Canadian Westinghouse Company were the successful contractors for the electrical equipment of the P. E. I. railway power house at this town, consisting of a 75 kw. direct current generator direct connected to a horizontal slide valve engine, switchboard, etc.

Montreal, Que.

C. Lapriere has obtained the contract for the electrical work for the Masonic Temple on Dorchester street.

The Hill Electric Switch Company, Limited, 1650 St. Lawrence Boulevard, have been awarded the contract to supply the new Workman building of McGill University with its equipment of main switchboard and panel boards. The panel board and cabinets for the new Eastern Townships Bank building in this city are also being built by the Hill Electric Company.

Orangeville, Ont.

W. A. Boos has obtained the contract for the distribution of 1,000 30-foot poles along the line of the Dufferin Power and Light Company.

Port Arthur, Ont.

Wood, Gundy & Company, Toronto, were the successful tenderers for the $67,400 debentures of this city. The amount consists of four issues as follows: $25,000 telephone; $7,000 street railway equipment, and $3,400 for the purchase of a water lot fronting Current River Park.

Quebec, Que.

The contract for the electric wiring of the Chateau Frontenac has been awarded to Thos. D. Lonergan, electrical contractor, this city.

St. John, N. B.

The West Side Committee have awarded the contract for lighting the No. 6 warehouse to the St. John Railway Company at $687. The Vaughan Electric Company tendered at $687.10.

Toronto, Ont.

Baker & Jordhal, general contractors, Manning Chambers, Toronto, are making the foundation test pits for the proposed new building of the Bell Telephone Company.

Winnipeg, Man.

The contract for constructing the telephone line from Lac du Bonnet to Point du Bois has been awarded to R. & D. McLeod at $6,000.

Annual Meeting of Mechanical Engineers.

The twentieth annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West 39th street, New York, December 1st to 4th. The president's address, to be delivered at the opening of the meeting, will be upon "The Conservation Idea as Applied to the American Society of Mechanical Engineers." A number of interesting addresses will be delivered, including papers upon aeronautics. Among the addresses will be one on Thursday, December 3rd, by Norman Litchfield, upon the durability of gears in electric railway service. Prof. F. C. Agner will deliver an address on Thursday afternoon, December 3rd, upon the "Possibilities of the Gasoline Turbine." On Friday, December 4th, Prof. Richard G. Dukes will deliver an address showing tests on friction clutches for power transmission.